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SCIENCE AND TECHNOLOGY

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10 APRIL 1987

EUROPE/LATIN AMERICA REPORT
SCIENCE AND TECHNOLOGY

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POLAND

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SPOT IMAGE PLANNING NEW LAUNCHES, WIDER MARKET

Paris LIBERATION in French 24 Dec 86 pp 20, 21

[Article by Vincent Tardieu: "Spot Orbits Around Its Market--The Satellite Makes Waves With Its Low Cost and Image Quality. Now It Is Time To Zero In on the Customers"; first paragraph is LIBERATION introduction]

[Text] Toulouse--Since the Spot 1 satellite's Ariane rocket launch from Kourou on 23 February [1986], it has been in polar orbit 832 km above the earth. Thanks to its two extraordinary high visual resolution eyes, it is the first civilian European satellite to observe the earth with precision from space, photographing details as small as 10 meters. Moreover, Spot 1 photographs the planet at a rate of 1,500 pictures per day. The task at hand now is to market this manna, even if it means encroaching on the territory of its American forerunner Landsat. Spot Image, created by the National Center for Space Studies [CNES] for distribution of satellite's pictures, has already had sales of Fr 20 million. Last week in Toulouse 400 experts met and tried to define the benefits of remote sensing--for topography, of course, but also for agriculture and national development.

"The finest technologies are not always commercial successes." This truism expressed by Jean-Louis Lions, president of CNES, was long pondered by the 400 remote sensing experts who met in Toulouse last week to learn the first lessons from operation of the Spot satellite. French representatives from Spot Image and CNES were of course present, as were officials from their Swedish (Satimage) and U.S. (SICOR) subsidiaries, satellite picture distributors, and future customers from the four corners of the planet. Representatives from agriculture and urban planning, geologists, and cartographers came to the Toulouse meeting, and even a few photographers. Spot 1, the first European observation satellite images is a major success: 200,000 geographic segments measuring 60 km by 60 km, called "scenes," have been photographed in 9 months; 50,000 of them are marketable (not too many clouds during the exposure), and 7,000 already have been sold. 1986 revenues for Spot Image come to about Fr 20 million, after 9 months of operation.

Moreover, the promoters of Spot announced that the line will be expanded soon, owing to Spot 1's earnings: Spot 2 will reportedly be launched about July 1987, Spot 3 in September 1989, and Spot 4 in 1992. Moreover, Spot 1 is not a fuel

guzzler: At this time, only 1.7 percent of its hydrazine fuel has been consumed, so the satellite might live 4 years instead of the 2 expected. Technically, Spot has received almost nothing but praise. It has not deviated from its course by more than 2.5 km, and picture quality is better than anticipated. Of seven temporary malfunctions, only the breakdown of last 31 August persists: One of the two Spot recorders, the No 1 instrument, failed to start up again after reprogramming. Solar flux is thought to be the cause of the incident. "Because of redundancy with the second recorder, this breakdown is not catastrophic," Andre Fontanel, general manager of Spot Image, explained. "It has had no effect whatever on picture quality." On the other hand, picture taking time has now been reduced to 30 minutes per day, but this is sufficient to meet the current demand.

The concern of the observation program officials originates from difficulties in determining the market for high-quality remote sensing. On the one hand, there is strong demand from certain unexpected quarters, such as the media (see below). On the other hand, Spot Image has difficulty in meeting the more specific needs of clients who do not come from an industrial group or a public organization, but from smaller companies. These "small clients," who are estimated at about 10 percent of the customer base, may be interested in a part of the picture, not in the total surface covered by a scene of 60 km by 60 km, which is too expensive for them. However, quarter scenes are not available on digital media (the magnetic tape based on which the work is actually done).

This new demand has surged in agriculture, geology, topography, and urban planning. Owing to the excellent precision of the Spot photos (10-meter resolution), Jean-Pierre Pincon of IGN (National Geographic Institute) hopes to make "deluxe maps" in which the range of error will not exceed two- to three-tenths of a millimeter (i.e., 10 meters on the ground, given a map scale of 1:50,000). Jean Kilian of CIRAD (Center for International Research and Development Cooperation), in turn, pointed out that, as for tropical agriculture, "it is possible to closely monitor the crops and vegetation of a region due to picture repetition and programming of these pictures at precise times of the year." CIRAD is currently conducting seven research projects with Spot Image. "Its excellent resolution makes it possible to distinguish crops which could not be seen with Landsat; for instance, two varieties of rice--one early, the other late--can be distinguished in the area of Lake Alaotra in Madagascar, and future harvests can be evaluated."

Urban planners are equally pleased, having discovered that Spot can produce maps at a scale of 1:25,000. Catherine Pedron, a young graduate of the recently instituted "DESS [degree program] in remote sensing" at Paul Sabatier University in Toulouse, is working on topographic evolution for this city: "I can clearly follow the developments at construction sites, roads, and parks. With photos which show the nondraining zones of the city, and with data available in the archives, a runoff factor can be calculated by neighborhood, making it possible to improve the drainage system." In all fields combined, 135 research laboratories now work from Spot images.

Still, some sectors are not responding as quickly as expected: Agricultural officials in particular continue to rely on traditional aerial photographs. Capturing certain foreign markets is also proving difficult: This applies particularly to the United States, where the pioneer Landsat satellite has been used for several years. The United States currently represents only 12 percent of Spot customers. But Spot management counts on its technical superiority to convince people: In panchromatic mode, the satellite detects shapes measuring less than 10 meters, whereas Landsat does not go below 30 meters, and Spot's stereoscopic process makes it possible to reconstruct the relief. Spot also covers the entire world, thanks to its recorders which store the pictures, whereas Landsat can only photograph areas covered by receiving station. For instance, only Spot takes pictures of Australia. In addition, Spot is the only programmable satellite of this type.

The market of developing countries is one of the most difficult to capture because these countries do not have the means to regularly purchase satellite data. Westerners, in particular, finance research based on satellite pictures. Orders from the African countries are no more than 2 percent, with 10 percent from Asia. The market thus remains mostly European and heavily French (54 percent).

But despite this difficult commercial penetration, Spot Image and its distributors are completely swamped. At the present time, a customer has to wait 3 to 6 months for custom-programmed pictures, and 1 to 2 months for archive photos. "This is not so long compared to the 6-month turnaround by Landsat in the beginning," replies Gerard Brachet, CEO of Spot Image. But in the future, the waiting period should not exceed 1 month, regardless of the type of picture. In order to alleviate this still persistent bottleneck, Spot Image had to double its French staff in 6 months and quadruple its U.S. staff in less than 1 year. By 1988, seven receiving stations will be installed around the world, in addition to the four already in France (Toulouse), Sweden (Kiruna), and Canada (Gatinar and Prince Albert).

Interest in Spot can really be verified as of 1987. The U.S. Congress, in fact has refused to vote funds for a new Landsat satellite, though the one in orbit should cease to operate next summer. Spot Image will suddenly find itself a near monopoly for 2 years.

[Box p 21 signed V.T. [Vincent Tardieu]

A Gold Mine for the Media

Whether for current event photos, such as those from Chernobyl, or archive photos, Spot is a reliable source of information which should be developed.

A trail of smoke over the Chernobyl power station and the gutted reactor, the partially destroyed oil terminal on Kharg island, the military submarine base on the Kola Peninsula in the Soviet Union.... Pictures of the world, taken by Spot are now available to those who have the money to buy them. The media

are, of course, greatly affected by this new source of information: With Spot, you can program your photo requirements. "The media have become our third largest customer, after renewable resources and topography," said David Julyan, marketing manager of Spot Image Corporation (SICOR), the U.S. subsidiary of Spot Image. For the centennial of the Statue of Liberty, this subsidiary turned a neat trick by selling the Spot picture of New York to the TV networks. Next, the U.S. networks were prepared to pay Media Network $150,000 for the exclusive picture of the Kola military facility, but unfortunately the picture quality was not good enough. Last 1 May, the same company (linked to Satimage, the Swedish subsidiary of Spot Image) beat out Spot Image by selling the French satellite's first photos of the Ukrainian power station.

"This uncivilized transaction taught us a lesson," admits Catherine Le Cochennec, information officer at Spot Image. In France, management in charge of marketing the satellite still does not seem convinced of the importance of this new field and is barely beginning to consider it. "It is no priority," Gerald Brachet, chief executive officer of Spot Image, is content to comment.

"There are two types of demand from the media," explains Catherine Le Cochennec. "First, the current event photos, such as Chernobyl. We will continue to program this type of photo, whatever the demand. Then there is demand on a simpler level for such varied subjects as forest fires or agriculture in some part of the world. We meet this type of demand from our archives. But journalists have to understand that these pictures cannot be obtained overnight. In the best of circumstances and by blocking the entire production chain, a picture can be obtained in 48 hours. And even for this, the satellite has to pass soon over the area to be photographed"--Spot passes over the same point every 3 days--"and there must not be any clouds and no processing must be necessary prior to distribution...." In other words, this type of photo is very expensive. "We negotiate each case separately, depending on the picture and the media. Figure less than FR 10,000 for an archive photo; for an exclusive photo, it may go as high as Fr 1 million."

"Spot provides a reliable source of information independent of governments and lobbies," L. Bjerkesjo, director of Satimage, emphasizes, "but this creates new responsibilities to the extent that use of satellite pictures may have serious consequences."

Is it necessary to set up a special code of ethics between the profession and the people in charge of remote sensing? "At least some understanding," Pierre Bescond, SICOR manager, states, "because the problem of interpreting satellite photos arises. All disinformation must be avoided." One thing is certain: Photo "interpreters" will become increasingly important in the future.

25053/12851
CSO: 3698/A085

FINLAND: 184 MILLION MARKKA BIOTECHNOLOGY PROGRAM 1988-1992

Helsinki HUFVUDSTADSBLADET in Swedish 31 Jan 87 p 15

[Article by Birgitta Jernvall Ingman]

[Text] Heavy investments in biotechnology seem to be justified, since this field is expected to become just as important as electronics and computer technology.

The Japanese, for example, believe that their future lies in this field and they have already taken the step from electronics to biotechnology.

This food for thought was given to listeners at the Finnish Academy yesterday when the academy presented its proposal for a national development program in biotechnology and molecular biology for 1988 to 1992. Just before this presentation, the program had been turned over to Prime Minister Kalevi Sorsa, who is chairman of the State Scientific Council. The proposal was developed by the Biotechnology Section of the academy, the chairman of which if Professor Pirjo Makela.

The goal is to achieve a significant improvement in our biotechnology research during that 5-year period--and in this way to promote the industry and to increase its competitive strength. Consequently, an additional 184 million markkas or 37 million per year should be spent on researcher training, equipment purchases, and research, according to the proposal.

"The main goal now is to lay the groundwork for applied research," Prof Makela said, pointing out that the distance between basic research and applied research is extremely short in biotechnology.

The working group stressed that a major effort is underway in biotechnology everywhere, but especially in the United States and Japan. The pace is accelerating and we will be left far behind if we do not act now, according to the study group.

We should concentrate especially on molecular plant biology and research dealing with the processing industry, according to Pirjo Makela. The results could be improved forest growth, a more environmentally sound wood-processing industry, and more resistant grains. Biotechnology should do well in Finland, she added, since it is based on what we have, i.e. well-trained people who are interested in research.

200 Projects

There is already strong interest in biotechnology research here. About 200 projects are now underway at technical institutes and research centers at 10 locations throughout the country. Most of the projects are small and inefficient, however. The problem is that there are too few researchers and their equipment is substandard and outdated, while there is no funding for large and efficient research groups working toward long-range goals.

The development program should double the number of researchers who are capable of using the new biotechnology methods. The program should also make the application of biotechnology in various fields of industry more efficient, it was pointed out.

Long History

Biotechnology has a long history, according to the working group that put together the development program. People have produced beer, wine, bread, and cheese for thousands of years, but only about 100 years ago was it discovered that these processes were based on microbes and their enzymes. The new development of biotechnology began in the 1950's. This is when the age of molecular biology began, according to Makela. The practical applications came with remarkable rapidity.

Research director Tor-Magnus Enari stated yesterday that biotechnology had raised great expectations. These expectations are sometimes too great, he said, but he added that biotechnology would be of great importance in our economy and in the medical industry, in particular. It will have little effect on jobs, however, he said.

9336
CSO: 3698/264

500 MILLION KRONER STATE SUPPORT TO DANISH BIOTECH

Stockholm NY TEKNIK in Swedish 29 Jan 87 p 7

[Article by Staffan Dahllof]

[Text] Copenhagen--Danish biotechnology will receive a governmental infusion of 500 million Danish kroner.

This investment is an attempt to introduce a new element into Danish research policy: an effort to steer research toward fields that promise economic growth. Education and Research Minister Bertel Haarder said that biotechnology was an area in which Denmark had a good chance of keeping up.

New research centers will be established at technical universities and private firms at a cost of 410 million kroner. New scholarships will be established for 70 million. Another 20 million kroner will be spent on information and technology evaluation.

The proposal was supported by a relatively large majority in parliament. The Social Democratic opposition called for special appropriations for research in environmentally sound agricultural technology, however. Similar demands for ethical and ecological considerations have been raised by environmentalist organizations.

The joy at Danish universities and technical institutes is not unanimous, however. The new appropriations were preceded by a general call for cutbacks and savings measures.

This could destroy long-range planning in research.

There is a serious risk that researchers will pay more attention to the government's desire for profitable projects than to the scientific value of their research, union representatives for teachers at universities and technical institutes warned.

9336
CSO: 3698/264

FRG-PRC COLLABORATION ON MPC75 AIRCRAFT

Duesseldorf VDI NACHRICHTEN in German 9 Jan 87 p 1

[Article by Barbara Odrich: "Development of a Medium-Range Commercial Airplane: European-Asian Cooperation?: Sales Potential Estimated at 1,200 Units"]

[Text] Tokyo, 9 Jan 87 (VDI-N)--Far-reaching cooperative agreements on commercial aircraft construction between European and Asian companies can be expected in the current year. The initiator of the program currently known as MPC75 is the German aircraft manufacturer MBB, in Munich. This West German company has been negotiating for some time with partners in the Far East and in Europe.

The Chinese CATEC (China National Aero-Technology Import and Export Corporation) is also involved in preliminary studies. The goal of both MBB and the state-owned Chinese airplane industry is to win over the Japanese aircraft manufacturers--in concrete terms Mitsubishi Heavy Industries, Kawasaki Heavy Industries and Fuji Heavy Industries--as partners. In Europe, MBB is negotiating with the Dutch aircraft producer Fokker, for whom the MPC75 would provide a significant complement to its other offerings in commercial aircraft.

From the West German (MBB) point of view, the involvement of other partners is an obvious advantage. This is in order to distribute the burden of financing--at least $2 million in developmental costs plus the later investments in serial production--as well as to expand the potential market for the new airplane.

Preliminary decisions on the joint project are expected in 1987. The decision on manufacture will probably not be reached until 1992. The licensing of the new aircraft could then be expected around 1995-96. Sales potential for the airplane is estimated at up to 1,200 units, of which only up to 200 could be taken by Chinese civil aviation.

12271
CSO: 3698/297

FRG: MBB'S FLY-BY-LIGHT SYSTEM APPLICATIONS

Duesseldorf VDI NACHRICHTEN in German 13 Feb 87 p 21

[Article: "Fly-by-Light Said to Increase Flight Safety: The Pilot Flies the Airplane Using Light: Smart Control System With Networks of Optical Fibers"; first paragraph is introduction]

[Text] Hamburg, 13 Feb 87 (VDI-N)--A smart control system for aircraft construction with networks made of optical fibers is currently being developed by Messerschmidt-Boelkow-Blohm (MBB) in Hamburg and Bremen. This system makes use of multicolored light to transmit control commands from the cockpit to the airplane's flight controls and is said to be distinguished by a small degree of susceptibility to interference and a high level of safety.

A new type of control system known as LECOS, derived from the English "Light Electronic Control System," is currently being developed at MBB. It uses optical glass fiber and multicolored light to transmit control commands from the cockpit to the flight controls of an airplane. The general idea of the method, which is said to be distinguished by a small degree of susceptibility to interference and a high level of safety, was developed by the MBB Transport and Commercial Aircraft Company Group and patented worldwide. It is hoped in Hamburg that a prototype for laboratory applications will be available in 2 to 3 years.

The classical type of airplane control is purely mechanical: using cables and gears and with hydraulic servos, the flight controls of, for example, the control surfaces on the wings and tail group are moved. Most recently, electrical wiring has replaced cables and gears for signal transmission. The control units on the moving parts are then driven by electric motors with servo power. This procedure, known in the jargon as fly-by-wire, is found in secondary control areas of the A 310 application.

The secondary controls include the non-essential flight controls units, such as spoilers, air brakes or wing flaps. Moreover, this piloting philosophy has also been extended to components of the primary controls (elevators, ailerons).

The next technological step for the flow of flight control information within an airplane is called fly-by-light. Optical paths replace wires as the

conduit of information. Using optical fibers as thin as a human hair, it is possible to construct in the airplane a close-meshed optical system that, according to an ingenious system, can be interconnected such that even in the case of failure of optical paths or entire networks, the information from the cockpit can always use alternate paths to reach its target, be it the motor operator of an aileron or the hydraulic power release of the landing gear.

Similar to how the human nervous system continues to be functional after nerve bundles in parts of the body fail, the "addressee" in the airplane should be able to continue to receive its information safely using the MBB LECOS system--thus meaning that the piloting function remains intact.

According to company information, the safety inherent in the LECOS system comes from a triple, parallel path system for signal transmission, from the permanent, separate control of all optical paths, including their optical networks, and from the monitoring role of the microprocessors, which ultimately issue the control sequence.

The optical conductors are thus simply the paths through which light carries information or signals. The information consists of digital, telegram-style words that are impressed on the ray of light. The information is transported at nearly the speed of light. All of these steps take place in parallel fashion using three carriers, which consist of colored light at three different frequencies. These three media are fed into the optical network parallel to one another.

The advantage of this system is that a disruption through the injection of outside light onto the transmission paths is not possible. Stray light would not only have to use the exact same chrominance subcarrier in all three cases, but would also have to make use of the same "telegram address." And this is impossible, according to MBB.

If, for example, an information signal is sent from the cockpit in its parallel blue, red and green optical paths, then the system knows on the basis of its test options which color is carrying the correct signal, or rather which color is relevant to the signal in the case of failure of sections of the optical path. All of these procedures are clearly programmed in advance.

In an airplane, this sequence takes place as follows. If, for example, the pilot or the programmed autopilot takes action by engaging the elevator controls, then the microprocessor connected to the pilot controls in the cockpit emits a control signal. This signal is then converted into three parallel light signals via a light transmitter (optronic information system) and then, supplied with the corresponding "address," is sent to the smart elevator servo via the optical network.

The elevator servo consists of a light receiver that transforms the light signal back into an electrical one. The electrical signal, together with the digital control command contained in it, goes to the microprocessor in the elevator. Finally, the microprocessor causes the control maneuver. As stated, all this takes place at nearly the speed of light, thus at around 300,000 km per second.

In other words, the control commands from the cockpit, redundantly generated in three colors, are supplied to the identically redundant, three-part smart motor operators at the elevator unit via the optical network. All of the control maneuvers transmitted in the airplane via the optical network are present at every system point. This has the following advantages:

Should meshes of optical fiber and coupling junctions be disturbed or destroyed, all information in the rest of the network remains completely intact;

Failed or disturbed components and transmission systems are thus either covered by parallel, functional components and transmission paths, or their functions are assumed by other units, which then defer other less important functions. This guarantees that under all conceivable circumstances the steering functions of an airplane will always remain functional. There must only be a guarantee that the transmission system is continually supplied with the necessary energy.

For the first time in flight control technology, according to MBB, it will be possible to maintain control over an airplane and thus continue a flight after the failure or disruption of significant components of the piloting or transmission systems. Another reported advantage is that this type of system can be operated with considerably reduced maintenance costs. Optical flight control technology would set entirely new standards for airplanes in the future.

This sectional technology for steering systems can be applied not only to aircraft construction, but also to land vehicles and sea vessels, and as a control and monitoring system for industrial processes.

12271
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FRG REPORTS SET OBJECTIVES FOR INFORMATION TECHNOLOGIES

Queisser Report

Bonn INFORMATIONSTECHNIK: FOERDERUNG DER INSTITUTIONELLEN FORSCHUNG UND ENTWICKLUNG in German Oct 85 pp 7-9, 15, 62-67, 69-72, 76-77

[Excerpted sections from "Information Technology: Support for Institutional Research and Development," Report of the Queisser Commission of the Federal Ministry of Research and Technology presented by Hans-Joachim Queisser, Chair, Friedel Hossfeld, Ernst Lueder, Max Syrbe, and Norbert Szperski, 77 pages.]

[Text] A. Summary and Recommendations

Because of the rapid development of microelectronics, information technology is faced with decisive upheavals. Data processing, communications technologies, and industrial automation are going to develop rapidly and have a deep-reaching effect on the entire economy of the Federal Republic. Far-sighted, basic research at the institutional level must be significantly strengthened. This report identifies important subject areas in which the federal government can bolster its support for this kind of research. It suggests areas of application for interdisciplinary cooperation. In the next few years, at least 2500 scientists--in addition to the approximately 1700 scientists active today--should address themselves to the research work described in the individual areas covered by this report.

The subject areas recommended here deal with the materials and components used in micro-electronics, semi-conductor process engineering, software engineering, computer architecture, communications technology, and questions that have social and economic importance for information technology. Discussion of the individual topics provides detailed estimates of the number of additional personnel needed if we are to achieve an internationally competitive posture, as reflected by the committee's own views and in our discussions with specialists in German industry.

B. Introduction

The occasion for this report was a request from the Federal Minister for Research and Technology, Dr. Heinz Riesenhuber, that he receive a position report on information technology in the Federal Republic of Germany, together with recommendations for strengthening future support on an institutional

basis. In February 1985 a study group began to consider the task. Several discussion and editorial sessions, questionnaires directed to industry specialists, and a two-day closed-door meeting with experts and industrial managers served to coordinate the effort.

Under the topic of information technology--as also used in the government report "Information Technology" (The Federal Government Concept for Subsidizing the Development of the Microelectronics Industry, Information Engineering, and Communications Engineering; Bonn 1984)--we understand the entire range of technology influenced by the rapid development of microelectronics for information [storage and transfer], including industrial automation and communication. Microelectronics, together with advanced semi-conductor technology, represents the basis on which the new communications techniques, as well as modern developments in data processing and industrial automation, are based. These areas are especially important for every national economy; with a previously unknown urgency, any future technical progress and economic success is dependent on basic scientific research in this area. The Federal Republic of Germany must strengthen its efforts along these lines.

The goal of this report is to make as many statistical estimations as possible in order to identify research and development that the government should be supporting in the area of information technology, as well as pin-pointing topics that are particularly important and appropriate. Institutionally organized research and development affords the possibility of forward-looking, preparatory research, development, and training for the benefit of future industrial utilization. Research institutions supported by the federal and state governments can conduct especially effective leading-edge research, specifically in the area of information technology; this report makes detailed suggestions in this regard.

The following section indicates the significance of information technology and illustrates current developments in the field, as well as the comparatively unfavorable situation in the Federal Republic. Based on this discussion, the report follows with guidelines for rapid action. Section D presents detailed suggestions for subject areas of concentration. This list is divided up into six areas. First, the most important promising materials are dealt with together with the components derived from them, also including sensors and actuators. Secondly, we deal with topics related to process engineering and related equipment. The third discussion area describes basic software engineering concerns. Computer architectures are discussed in the fourth section, with specific concentration on future systems. Communications techniques, with special consideration for digital processing and optical techniques, follows as the next topic. The last chapter covers the markets for information technology and, because of the enormous social consequences posed by these new technologies, underscores subject areas that require prompt research into the social and economic aspects involved.

Section E deals with the various areas of basic and interdisciplinary research in exemplary application fields, together with key planning targets. This represents an attempt to identify research-intensive fields of economic importance for the future and to recommend areas for interactive, interdisciplinary work. Section F provides a list of recommendations for organizational implementation of the research and development goals cited earlier; this section is

specifically based on suggestions that evolved from representatives of industry during the closed-door conference.

D. List of Topics

We are dividing our list of topics into six areas. First, we will discuss basic research for materials, components, and essential new technical processes; then we will deal with topics relating to software-technology, computer architectures, and communications engineering. Social and economic topics will be described at the end of the report. After each topic description, we have listed a very rough, estimated number of scientists needed to carry on future research in that area. The approximate financial requirements involved can be estimated based on this number; secondly, this number indicates a weighting in terms of priorities. In spite of the very different importance and starkly varying character of these research topics, we tried to achieve a consensus among the specialists. In this regard we discussed and weighed the relative merits of current international status, significance, and market development, as well as whether the Federal Republic is lagging behind in a given area and what our chances are for the future. The original estimation of additional personnel requirements made among the members of the committee turned out to be significantly lower [than the values indicated here]. However, careful discussion during the two-day closed-door session with specialists from industry revealed significantly broader gaps in current activities in the Federal Republic; representatives of industry expect a much higher contribution in terms of foresighted research and more thorough technical training from the institutions. For one thing, the very keen need for research and development in the many areas of software technology stood out. Secondly, there is a strong need primarily in communications engineering, because labs associated with postal and telegraph institutions in competing countries are conducting a great deal of research work in this field, although the Federal Republic has not as yet produced any comparable effort. Strictly in terms of research expenditure per population unit, it will actually take the increase in scientific personnel stated here to catch up to the industrial countries with which we compete. In other fields, such as nuclear engineering or high-energy physics, the successes of the Federal Republic have only been possible as a result of efforts comparable to those suggested here.

The great number of supplemental activities required has been very intensively discussed. This kind of heavy expansion of scientific personnel must take place carefully and in logical steps so that specialists are not siphoned off from industry. Thus the numbers represent a scale against which we can measure a step-by-step approach to the final configuration we are striving for. Furthermore, state support of research activities must be associated with the training of highly specialized experts, who for the most part should then transfer to laboratories and manufacturing facilities in private industry.

E. Application Areas

I. Areas of Application for Systematic Problem Solving

Ia. Pattern Recognition

The application of information technology to complex tasks demands observation of complex relationships, called scenes, which are most essentially represented in the form of mobile, three-dimensional images, language, and multi-sensor systems. It is currently possible to achieve progress in all three areas by combining models for the description of signal sources, scenes, and application fields ("world model"), and by using high-speed algorithms and special processors.

Hierarchical structured systems will evolve to utilize data, information, knowledge, and artificial intelligence in stages. Thus knowledge-based methods will be integrated, leading from "recognition" to "understanding," which allows for quantitative and qualitative progress. In the process the search for optimum parameters and procedures remains relevant, even in terms of a theoretical superstructure.

The systems that will set the pace for the application of pattern recognition in industry involve primarily "machine vision" (quality control, product identification, robot control, and process control) and "speech recognition and processing" (speech-controlled machines). Information is collected in digital form using sensors (e.g. T.V. cameras, microphones) and must be formatted, analyzed and interpreted appropriately. The more exact the digital map of an image or of language, the greater the processing cost. First of all, this requires greater computer power, and secondly, more intelligent algorithms because the processing steps have to bake place in real time.

Using "machine vision" as an example, the following list provides an in depth look at the main research directions we foresee:

-- Hierarchical model-supported systems using knowledge-based methods;
-- The combination of various bits of information, e.g. from various sensors (image-forming multi-spectral, multi-location, and distance measuring) or different types of sensors (acoustic, visual, tactile);
-- Value analysis of purposed systems (output, costs, acceptance of ergonimic worker conditions);
-- Forward-directed applications for autonomous mobile systems (mobile robots, transport equipment, driverless traffic) and for the interpretation of natural scenes (street traffic, rail switching, in-plant traffic, building security).

There is a close relationship between this area and speech processing (Chapter D. VIc.).

Personnel investment: 100 scientists

Ib. Knowledge Processing

Starting from methods used in artificial intelligence, which must be further developed, and using advanced computer systems, we need to find ways of reaching solutions to complex tasking problems even if the algorithm directly affecting the problem is unknown. Conventional computer systems are designed to solve tasks in the range of numerical and Boolean problems, text processing, processing of primarily homogeneous mass data and other specified solution paths (algorithms). In contrast, knowledge processing systems (special expert systems) should themselves develop problem-solving capabilities through:
-- Acquisition and organization of expert and background knowledge
-- Associative memory access (content addressing)
-- Heterogeneous, dynamic data structures,
-- Automatic lines of reasoning that make available non-explicit stored knowledge.

In particular, further development of methods for representing knowledge is necessary, and to a great extent, so is automatic knowledge acquisition (learning process), whereby questions of consistency, reliability, and completeness are of particular importance.

Expert systems are important, particularly from two standpoints. First of all, they provide a faster, on the average even more reliable, tool for solving complex assignments than has previously been the case, particularly when they take the form of work-station computers operating on-line as part of a computer network. They can be categorized in three classes:

(1) Planning and design systems, for instance:
- -- Design systems for complex technical tasks such as designing VLSI components,
- -- Municipal and state planning.

(2) Diagnosis systems, for instance,
- -- Remote machine failure diagnosis (remote servicing),
- -- Medical diagnosis and therapy.

(3) Recognition systems such as those cited in Chapter Ia.

Secondly, expert systems, just like advanced robots, constitute valid research goals because:
-- On the one hand, they make it possible to compile and acquire an overview of knowledge that is difficult to structure, and
-- On the other hand, they provide a frame of reference for dealing with very important subtasks (e.g. knowledge acquisition) involving high knowledge and technical requirements.

The solution of subtasks and overall tasks results in advanced knowledge and has a exponential effect on innovation.

Multidisciplinary research is especially important for researching open-ended, long-term problem complexes involving knowledge processing; in addition to artificial intelligence and information science, psychology and computer linguistics in the sense of "cognitive science" are involved.

Personnel investment: 120 scientists

Ic. Numerical and Non-numerical Simulation

Based on advances in the areas of modelling, algorithms, and available computer power, the simulation of technical and non-technical systems has developed as a new, far-reaching, mostly very economical addition to the art of scientific and technical experimentation. It provides results more rapidly and more cheaply, and in some cases, results that would be otherwise unattainable. Numerical simulation plays an ever more decisive role for many central problem areas in physics, such as flow mechanics, plasma physics, the theory of elastic and plastic deformations, solid-state and semi-conductor physics, the theory of heat dissipation, problems in meteorology (medium-range weather forecasting), physical chemistry (reaction kinetics, explosion processes), mathematical models in biology and medicine, and to an increasing extent, models of economic processes as well, etc.

Instead of conducting experiments, or attendant to and in support of this kind of experimental work, complex mathematical models are created to describe the processes in question. However, the numerical processing of this kind of mathematical model leads in many cases to extremely large computer and memory requirements (processing and recording 10(6) to 10(9) data), thus exceeding the capacities of the numerical methods and of the fastest, largest computers in use today.

In fact, numerical solutions to a multitude of problems would go one or several orders beyond the computational capacity that is available to us today, but whose solution could lead to decisive progress in technological development or basic knowledge.

Although the tasks involved derive from a broad range of technical and scientific fields, and appear in some cases to be widely divergent, a very large class of these tasks is characterized by a remarkably unified basic mathematical structure, specifically partial differential equations.

Existing mathematical simulation models must be improved, new applications modeled, and the associated numerical processes improved. In particular, it is necessary to develop algorithms for dynamic and complex matrix structures (data dependent, adaptive processes, dynamic matrix refinements and simplifications, 3-D matrix structures), which must be studied in conjunction with finite-element, multi-grid, and Monte-Carlo processes with relationship to computer architectures.

Similar support for problem solving and experiments like that allowed by the numerical simulation of systems that can be described by differential equations is also needed for systems where performance is described by other, non-numerical laws, such as grammar, judicial laws, etc. Individual bits of knowledge are available in many locations and need to be compiled and passed on, both in support of and supported by the processing of knowledge.

Personnel investment: 35 scientists

Id. Control of Complex Processes for Operating Systems

The production area, characterized by operative systems, and its closely related service sector, involves logistical systems,and has to perform increasingly complex tasks. This increased complexity result from declining resources, environmental protection, and a demand for more humane working conditions--all while meeting heavy international competition. More than one third of the gross national product has to earned with exports. Meeting this challenge is primarily possible by virtue of "intelligent" products and adaptable, automatic production and service processes (e.g. CAD), which must increasingly be connected over distances, meaning communication takes place via electronic networks. The necessary continued development of the product selection and production/service structure will take more than a decade and poses even more new problems for research arising out of:

-- The functional integration of operative and logistical processes, even over distances,
-- The sequential integration of automated processes, while cutting reliance on buffers and warehousing,
-- Flexible production,
-- Assurance of high quality,
-- High availability and reliability together with minimum, well-managed maintenance,
-- High acceptance of the ergonomic relationship between the operator and the work station (see Chapter D, IIId),

etc.

The goal of these efforts is computer-integrated, flexible automated production (Computer-Integrated Manufacturing--CIM), that is "production control engineering."

When using information technology in production, which often is discussed in the narrower sense in terms of the concepts "process control engineering" and "sensor-guided, microprocessor-controlled machines," the growing importance of information flow in addition to the flow of materials and energy is characteristic. This is only possible in the presence of functional integration. Furthermore, it is necessary increase the flexibility of equipment and machines; the robot is an especially important example of this factor. Development in this area has to depend on advanced sensor and actuator systems. The former are designed either as multi-sensor or image sensor systems, which have to evaluate scene sequences (see Ia). This leads to information-oriented instead of signal-oriented systems.

The topics cited will gain importance in terms of both depth and breadth, hence we need to support at least the following key areas:

-- Basic principles for control of complex continuous and discontinuous operating processes using distributed, error-tolerant computer systems, system safety,
-- Interdepartmental integrated job order and production planning (production control engineering: methods, components, systems).
-- Advanced integrated process control technology supported by knowledge-based machine start-up and maintenance methods: methods, components, systems,

-- Automation of flexible machines and equipment (robotics),
-- Configuration of human-machine communication (Chapter D.IIId),
-- Computer-supported drafting and simulation of this type of production systems.

Personnel investment: 90 scientists

Ie. Control of Complex Sequences for Logistical Systems

Applications of information technology in office environments, which are the main application area for logistical systems, are already being introduced today on a wide scale. However, existing systems must and can be improved considerably. To this end, principles of information and organization science (e.g. non-determinative, non-algorithmic behavior by office authorities, behavior supported by knowledge-based components) must be worked out, and methods and procedures for modeling operating structures and procedures must be developed. In the process, growing importance is being placed on information-related system feedback, the team approach in work management, and increasing integration of operative systems. It is necessary to come to terms with communication flow, data structures, data retention, and the resulting interfaces, finding basic solutions for these areas, and developing them to the point where they are ready to be implemented.

In this context, both within the office area of an organization as well as in the information exchange between organizations, there are growing demands for accountability, and reliability have been voiced, in short a need for accountable, reliable communication. These demands lead to more reliable user identification, explicit authorization of users for access to certain system services, and finally to technically accountable authentication of transactions carried out by users in the system (compare Chapter D.Vh).

Further development of the cited topics will continue for the time being, so we are suggesting support of the following areas:
-- Systems-theoretical logistical systems based on the principles of information and organization science, modelling,
-- Multi-media implementation methods, in particular with regard to office authorities, cooperation, accountable, reliable communication,
-- Configuration of communication between human operators and machines, (Chapter D. IIId),
-- Data and system protection,
-- Computer aided design and simulation of this kind of logistical (service-oriented) systems.

Personnel investment: 60 scientists

II. Key Planning Goals

IIc. Model of a Flexible, Computer-Integrated Factory

Development of a production program like that outlined in Chapter E.Id leads to considerable changes in the structure, equipment, and operating sequences related to production. Consequently it would be advantageous to demonstrate

and study this system with reference to a practical application involving a complete future-oriented model factory. As an example, we could choose a difficult sector that is important for international competition, for instance the manufacture of terminal devices for the communication service industry, or the production of textiles.

This key goal integrates and demonstrates primarily the application fields involving the control of complex sequences for production and process control engineering, for human-machine communication, for data banks, and for knowledge processing, as well as to a certain extent for pattern recognition and simulation, supported by the results of work done in Section D, particularly with reference to communications engineering as well.

Personnel investment: covered in other chapters.

IId. Telemarketing with Consultation, Shipment, and Non-cash Payment

Telemarketing, based on capable, integrated communication services, is becoming more prevalent. This type of service utilizes the potential inherent in advanced information technology for the service sector. This trend reflects a development away from the standard mass product toward satisfaction of individual needs, supported by flexible manufacturing. Better procedures are required than those currently in use, particularly with reference to consultation, placing an accountable order, disposition of delivery, and non-cash payment procedures.

This goal integrates and demonstrates primarily application fields involving the control of complex sequences in the service sector, involving data banks, and knowledge processing, as well as human-machine communication. It is supported by the results of work done in Section D, and is closely related to communications engineering.

Personnel investment: covered in other chapters

IIe. Information Systems with Security Architecture for Public Administration or for Banks and Insurance Companies

Current efforts have not adequately met the demands made on office systems for legally binding data transfer, archive-safe document processing, data protection, identification and authorization of users, or office communication as legally binding dealings between partners ("Security Architecture," Chapter D.IVc, D.Vh, and E.Ie). Solutions to these problems should be demonstrated on the basis of an example of the tasks involved in public administration or the services provided by banks and insurance institutions.

Results from the following research and development projects must be integrated and demonstrated in order to master the practical demands made on information engineering systems in these application areas:

-- The basic principles [must be established] for developing a "formal pragmatic system" to deal systematically with the pragmatic relationships between users (areas of interest, responsibilities, standards).

-- Methods for modeling, specification, verification, and simulation of distributed systems with full consideration of pragmatic relationships.
-- Introduction of open systems, which will simultaneously fulfill the following functions: secure [data] transfer, archive-safe document handling, secure access control for users (identification, authorization).
-- Prototypical program systems for supporting office functions, allowing office transactions to assume the character of legally binding dealing and negotiation.
-- Office information systems that take into complete account the pragmatic status of information objects.
-- Error-tolerant computer systems, active identification boards (chip boards, identification techniques based on the human voice or other individual characteristics, encoding techniques, safe arithmetic systems.

Personnel investment: covered in other chapters.

IIf. Automatic Translation Systems for European or Asiatic Languages

Comprehension of language is one of the essential cognitive capabilities of the human mind, which means that processing natural language with the aid of computer programs represents a complex task. Computer programs based on the understanding of content make automatic translation and the automatic production of short content summaries possible.

Therefore automatic translation systems can integrate and demonstrate the following research results:

-- Automatic use of generally limited semantic information,
-- Simple checking and correction of automatic translations by a human translator (if possible during interactive text analysis),
-- The use of back references (anaphoric, pronominal references)
-- A system of generative semantics, even for multilingual translation systems.

Automatic translation systems require the use of dictionary searches, decomposition and derivation rules, recognition of idiomatic phrases, and syntactical and semantic analyses. Computerized translation systems must access the content of digitally stored documents in order to produce automatic "abstracts." For this purpose, the recognition component must be coordinated with a "document generator."

These natural language processing systems require both a large memory capacity in order to store an extensive vocabulary, the necessary rules, and the relationships involved, as well as storage and retrieval routines for rapid manipulation of this information when needed (capacity for exponential growth). These systems specifically represent a practical application of parallel processing and knowledge-processing procedures.

Personnel investment: covered in other chapters.

IIg. Weather and Emission Dispersion Predictions

Weather forecasting and predictions concerning environmental dangers, such as the spread of hazardous materials (in the air, water, or soil), require the output capacity afforded by the simulation of complex processes. Therefore this application area is particularly appropriate for integration and demonstration of applications involving simulation, knowledge processing, data banks, and human-machine communication, based on the operating results of Section D, specifically with regard to computer architecture.

Personnel investment: covered in other chapters.

Appendix: Overview of the Personnel Investment with Respect to the Research Suggestions

Sequential # of Heading	Subtopic	Scientists/Year	
I	Materials & Components		
Ia	Semiconductors	120	
Ib	Optically applicable materials	30	
Ic	Epitaxy	50	
Id	Insulation materials	15	
Ie	Organic materials	15	
If	Component Principles	30	
Ig	Sensors and actuators	90	350
II	Semiconductor Processing Technology		
IIa	Passivation and metallization	80	
IIb	Microstructuring, non-thermal processes	100	
IIc	Process simulation	50	
IId	Analytical methods	50	
IIe	Design and testing	200	
IIf	Equipment development	150	
IIg	Production organization	15	645
III	Software Technology		
IIIa	Software production environment	150	
IIIb	Descriptive languages and organizational imbedding	80	
IIIc	Basic software	180	
IIId	Human-computer-communication	100	510
IV	Computer Architecture		
IVa	Parallel computers	130	
IVb	VLSI architectures	50	
	Key project: parallel computers with systolic architecture	40	
IVc	Parallel computers	130	
IVd	Computer arithmetic	10	270

Sequential # of Heading	Subtopic	Scientists/Year	
V	**Communications Technology**		
Va	Rapid digital signal processing	50	
	Key project: signal processor	15	
Vb	Digital exchange technology, networks and services	150	
Vc	Processing speech, sound, graphics and images	100	
Vd	Optical communications technology	40	
Ve	Optimization of circuitry & systems	20	
Vf	Neurological signal processing in the brain	20	
Vg	Display techniques	60	
	Key project: ferro-electrical LC display	20	
Vh	Terminals and office communication	160	635
VI	**Marketing and Economic and Social Implications**		
VIa	Business contributions	30	
VIb	Total economic restructuring	20	
VIc	Social and legal framework	30	80
E.I	**Application Areas**		
Ia	Pattern recognition	100	
Ib	Knowledge processing	120	
Ic	Numerical and non-numerical simulation	35	
Id	Control of complex sequences in operating systems	90	
Ie	Control of complex sequences in logistical systems	60	
If	Data banks	50	455
	Total Personnel Investment		2945

Conceptual Framework

Bonn RAHMENKONZEPT ZUM AUSBAU DER GRUNDLAGENFORSCHUNG FUER DIE INFORMATIONSTECHNIK in German 1986 pp 7-20

[Excerpt from "Conceptual Framework for Expansion of Basic Research in Information Technology," Report Issued by the Federal Minister for Research and Technology, 10 pp]

[Text] The concept for supporting development of microelectronic engineering, information technology, and communications engineering adopted in 1984 by the federal government (Government Report on Information Technology) emphasizes the importance of research with approaches to industry and states the following:

> "Applied research with approaches to industry is currently being conducted in several larger institutes, primarily within the framework of the Society for Mathematics and Data Processing (SMDP), the Fraunhofer Society, and the Heinrich-Hertz Institute GmbH. In addition to these efforts, there are individual activities in several large research centers and technical universities. There are almost no research laboratories that bring researchers together from industry, public research facilities, and universities for a specific period of time to work on a single research task, after completion of which [the researchers] return to their various positions, providing effective transfer of their research findings."

Information technology is characterized by the fact that basic work must be translated very rapidly into industrial development if continuity is not going to be lost. Basic and applied research cannot be sharply distinguished from each other. They mutually enrich each other. Applied research with in the forefront of industry must be able to make contact with a broad, productive system of basic research. In this regard, the government report states:

> "Current capacities for basic research in the area of information technology are inadequate in the view of the federal government."

The Federal Minister for Research and Technology has taken the first step by making 100 million DM available to the German Research Association (GRA) over a five year period for strengthening basic research, with the provision that the GRA will continue to expand its involvement in this area.

The federal government has also provided the stimulus for the Max Planck Society (MPS) to expand its research activities in the field of information technology. The planning committee of the MPS is currently examining the possibility of establishing an institute [for this purpose].

As an additional step, the Juelich Nuclear Research Institute (NRI) has made plans to develop a new research center for basic engineering related to information technology, and the first steps in this direction have already been taken. A special section has been formed in the NRI, designed to establish a close link between applied research in the forefront of industry and basic research, primarily in the area of solid-state physics. Besides this effort, the NRI is cooperating with the SMDP to develop a high-performance computer center.

In order to work out a solid basis for developing research capacities, Federal Minister Dr. Riesenhuber has called together a working committee of five esteemed scientists under to chairmanship of Prof. Queisser, which has submitted their suggestions ("Queisser Report") in the fall of 1985, after extensive discussions with German industry. Since then, the Queisser Report has been forwarded to research institutions and scientific organizations, with the request that they examine which areas and in what structure their involvement in the area of information technology could be intensified.

The conceptual framework presented here by the Federal Minister for Research and Technology picks up where the considerations of the working committee left off. It extends beyond the time frame of the government report on information technology into the mid 90's. Given the long-term nature of this framework, it follows that the actual realization of the conceptual framework is not cast in stone for all time, but rather that it will require constant reevaluation and further development.

The conceptual framework pursues the following qualitative goals:

1. Long-term research in key areas of information technology shall be expanded in cooperation with state research facilities, universities, and industry in such a way that we can achieve leading positions, even on the international scale.

2. In selecting major research topics, long-term market perspectives and public needs must be taken into consideration.

3. Support will be provided to encourage scientists to risk the transition from basic research into industrial applications.

4. It should be possible for even medium-sized firms to make broad use of research findings.

2. Reasons for Expansion

The basic reason for this support is the extraordinarily large distortion of the competitive process as a result of government intervention.

In the United States, about 26,000 scientists and engineers are active in government research facilities (not counting universities) in the area of information technology, in contrast to 1400 to 1700 in the Federal Republic of Germany, which means in comparison three to four times as many researchers per population unit. In addition to this, in 1985 the American Department of Defense issued research and development grants worth over 20 billion DM to companies, universities, and research centers. In contrast, in that same year, if we count everything, the Federal Republic provided 800 million DM in support. In terms of relative population, this translates into governmental involvement in the US that is five times that of the Federal Republic.

In Japan, the telephone company NTT alone applied 1 billion DM per year to research in the forefront of industry. In addition to this, we have to consider the research efforts of MITI, which provides long-term support for joint research projects by companies and research institutions in future-

oriented fields of information technology. Familiar examples include the X-ray lithography project, the super computer project, the project for development of the 5th computer generation, the joint laboratory for optical components, or the MITI software project.

A further justification for this kind of support is the exponential effect of the availability of modern information technology for the critical branches of industry in the Federal Republic of Germany. Know-how related to information technology is needed not only in manufacturing industries, but also to a greater extent by the end users, which means that the economic significance of this area is much greater than the market for information technology in the narrow sense, which is already considerable in itself. It can be pegged currently at 40 to 50 billion DM/year, and is estimated at 70 to 80 billion DM for 1990 (without including the services of the German Federal Postal Service). There is hardly any branch of industry that does not employ information technology sooner or later. In the opinion of the experts, early availability of research findings in the area of information technology will above all decisively increase the competitive capability of the German export industry, primarily automotive manufacturing and the mechanical engineering.

In the past on the whole, German and European industry has lost ground with respect to Japan and the USA in the area of information technology. The corrective measures suggested in the government report on information technology, supported by European cooperation and financial support, counteracts this trend. In the interim we can cite notable success in several areas. However, the situation appears to be becoming more difficult again as a result of increasing tendencies to limit technology transfer across national borders, which makes strategies for filling the gap more problematic. Europe must have access to an independent technology base, and this can only be achieved through state-of-the art research findings.

In addition to these general observations, there is also the necessity to conduct additional research primarily because research in information technology is becoming more and more research intensive, and is increasingly approaching boundaries which cannot be crossed without basic research. This situation gives basic research a goal orientation (for instance with regard to the computer generation after next and integrated circuits, to algorithms for extreme data compression, or to software verification procedures), all of which represents a great challenge for scientists.

Increasing dependence on basic research in semi-conductor technology is particularly drastic: from exotic material characteristics to acceleration techniques in high energy physics, to observation of smaller and smaller structures from the standpoint of the quantum theory, to the use of new mathematical algorithms for the simulation of multiparticle systems.

The design of computer architectures and software and the control of computer networks have also reached limits requiring new mathematical processes and systematic basic research.

Another example is the area of knowledge processing, which brings mathematics, linguistics, and the engineering sciences into a very close relationship.

In the future, research into information processing with reference to biological systems may produce very new bodies of knowledge. The superiority of biological systems with respect to recognition, associative information storage, or sensory perception represents a field of research that opens perspectives no one can predict at the moment.

3. Primary Long-term Research Tasks

The Queisser Report indicates the research effort required, although there are a series of research topics that were not included in the report because they were assigned a lower priority or were assumed to be covered adequately already. Nonetheless, it is necessary once more to make clear from a goal-oriented standpoint which research tasks should be assigned the highest priority in the opinion of the Federal Minister for Research and Technology.

The priorities stated in this conceptual framework are based on the assumption that two major goals stand in the foreground of basic research if we are to ensure the future of German industry, and solve future problems related to rational energy utilization, environmental protection, and other important areas:

1. Control of complex networked information processing systems remains unsolved in many areas. Demands made on programs, computers, and human-machine interfaces are increasing constantly. This applies to industry as well as to the private and public service sectors. When designing complex systems, the question remains open whether these designs will meet the stated requirements. In many cases problem solutions fail at many levels, right down to the level of the interface between human operators and the machine. Hence the first goal is to research methods and techniques to facilitate the control of complex networked systems.

2. Innovative linking of mechanical engineering and electronics characterizes many branches of industry. In industrial manufacturing, but also in complex technical production, the connection of digital microprocessors or computers with an analog-oriented outside world represents an extraordinarily multifaceted problem area. Therefore the second goal involves researching methods and techniques for integrating process controls with the recognition of sequences in increasingly complex structures employing further information processing.

Both goals are of central importance in a national economy that is less dependent on uniform mass production than on a broad palette of specific problem solutions and customer-oriented quality products.

Innovative solutions are based on key technologies; their prompt mastery requires broad faceted basic research, frequently involving the combination of entirely diverse areas of knowledge.

As we go on to fill out more of the conceptual framework, it will be necessary first to address those sub-categories in which we can recognize the potential for especially favorable results with respect to personnel, technical, and industrial considerations. We need to set our priorities where it is apparent

that technology transfer from research to industry is possible and projected results look promising. Furthermore, it is essential to identify key projects and application areas that can contribute to an orientation of our basic research, motivating and integrating the research groups taking part. The Queisser Report contains a number of interesting suggestions in this regard.

For the time being, the following research tasks should be in the foreground of technical discussions:

-- Development of a design, production equipment and technology for integrated circuits in the range of 0.2 to 0.3 micron structures on a silicon base for highly complex systems resident on one chip.

-- Development of materials and processes for the assembly of modern semiconductor components with high integration and high performance density (assembly and connection techniques) for solution of problems related to heat dissipation, thermal stresses, and high pin density (up to 400 connections per chip).

-- Extremely rapid signal processing in the electronic and optical area using new kinds of algorithms, special processors, and semi-conductor connectors for digital communications engineering systems, entertainment electronics, and image processing.

-- Future technology for modern sensors for mechanical engineering, measurement and control, automotive engineering, and environmental protection (glass fibers, integrated optics, silicon micro-mechanics, ion and gas sensitive materials).

-- Architectures, operating system strategies, and supplemental programing media for application-oriented, high-grade parallel operating computer systems.

-- Methods and equipment for error and trouble-free hard and software systems (fail-safe architectures).

-- Design techniques and basic research on knowledge-based systems.

-- Procedures and systems for recognition and evaluation of stationary and moving images, for instance for vehicle and robot control, or for quality inspection of products and detail parts.

-- New principles for information processing, for instance analogous to biological information processing.

-- Basic principles for new types of storage media and peripheral techniques.

-- Architectural models and design strategies for VLSI chips with more than 10(8) transistor functions, equipped with an internal self-testing capability for circuit components.

-- Development of display technologies, for instance a high-resolution flat screen display.

We should not overlook research into associated economic and sociological effects as a contribution to introduction strategies and problem-solving alternatives, to aid in formulating governmental guidelines, and as support for well-informed public discussion.

4. Cooperation between the Federal and State Governments, Universities, Research Agencies, and Industry

Expansion of the research infrastructure in the area of information technology first of all requires substantial priorities, but is critically limited by the shortage of qualified leadership personnel. This results in the necessity for cooperation. In light of the continuing need for European cooperation, we cannot neglect to adopt a nation-wide, coordinated policy for setting research priorities. The conceptual framework of the Federal Ministry for Research and Technology should provide a contribution in this regard, and it should inspire the individual states, in dialog with the federal government and in continuation of activities they have already initiated, to contribute to a strengthened research infrastructure in the area of information technology,.

The universities represent one focus for basic research, and it will behoove them to expand the broad range of their own capacities for research and teaching in the area of information technology. The Queisser Report can serve as an orientation tool in this regard. The federal government is already providing assistance in the expansion of basic research via the German Research Community and through joint financing of acquisition procedures within the framework of the University Construction Support Law. Besides this, the universities are involved in numerous joint projects with the Federal Ministry for Research and Technology. Characteristic of these joint projects is the building of bridges between basic-research-oriented university research, other research facilities, and application-related industrial research. This cooperation is to be further developed.

Long-term task assignments connected with high investments often exceed the capability of exclusive university institutes. Jointly supported research organizations like the Max Plank Institute and the Fraunhofer Society, large research facilities, and institutes on the so-called Blue List are then the standard solution. But here too it is important to establish contact with the universities, whether this involves joint personnel appointments or cooperative projects.

It is possible to see problems arising from the need for goal-oriented research work in the area of information technology if we understand this as a limitation of research freedom. This would be a misunderstanding, however, for freedom in research and orientation toward specific key goals formulated together with industry do not represent a contradiction, they are a prerequisite for success. Without guideline goals, the synergistic effects characteristic of information technology cannot be realized, and without the creativity of scientific research to blaze new trails, these goals cannot be achieved.

For instance, high resolution television as a key research goal touches on various areas of basic research. Information from test results must combine from mathematical algorithms, data compression, anthropotechnical studies in image recognition by humans, and new circuit materials in order to make commercial industrial development possible.

It follows then that industry must be involved from an early stage in the formulation of this kind of key goal and if possible also in the basic work involved, because otherwise the orientation is lacking and the transfer of research findings encounters barriers in understanding. However, it also follows that this kind of key goal is only possible and can undergo further development only within a broad framework of basic research. Pure knowledge-oriented and strongly purpose-oriented basic research mutually augment and affect each other.

The link between basic research and long-term projections of future markets involves the difficult, but central task of building up a capable research infrastructure in the area of information technology. It requires a trusting cooperation between industry, the scientific community, and the government, and a clear increase in industrial involvement in basic research. Industry must also see the necessity of developing its own potential for basic research beyond short-term market expectations, thus becoming a participant in long-term research. For only to the degree that this is possible will the transfer of leading-edge research from outside industry into industrial research and development succeed.

5. European and International Cooperation

The necessity for closer cooperation in the European Community is obvious. No member country of the EEC can cover the entire gamut of information technology. Highly qualified scientists and engineers are our rarest resource. Each member country has its research strengths and weaknesses. It makes sense to combine our strengths, and this is possible only with close cooperation.

With respect research in the forefront of industry, cooperation with advanced companies is of great value, and the combined demand for research findings or research equipment represents a significant catalyst.

The question presents itself as to what extent even institutional cooperation in the form of joint support for institutions makes any sense on the European level. Experience indicates that project-oriented, limited-time forms of cooperation are more likely to satisfy needs for high quality than are long-term, secured European research capacities. Project-oriented forms of cooperation also represent an opportunity for involving industrial research capacities in European cooperation.

The opportunity exists for essentially strengthening cooperation between national research institutions within the European Community, not only by increased exchange of guest researchers or working on joint projects within the framework of subsidized programs, but beyond these possibilities, we may see more incidence of appointing foreign nationals to institute directorships or other leadership functions than has been the case in the past. This cannot be merely an abstract goal; it will only be possible on the basis of closer cooperation in joint projects.

Consequently one goal of this conceptual framework is over the course of time to configure a goal-oriented European system of basic research in joint research laboratories. Examples of possible research projects include:

-- The EUREKA-project JESSI (Joint European Submicron Silicon), in which integrated circuits are to be developed and implemented in the 0.2-0.3 micron structure range (a).

-- The opening up of applications for high parallel super computers for the solution of numerical problems in basic research (b).

-- Research into biological information processing systems (c).

The three examples cited here illustrate three aspects of European research cooperation:

a) The JESSI project can only be implemented if European industry commits itself to the project. Consequently it is also being discussed in the framework of EUREKA. On the one hand, industry must be involved so that the equipment necessary for the research will be developed in the first place. There are only a few companies in Europe with the know-how to do this. In some cases, development may only be possible as a result of co-operation between the institutes and industry, as was the case with X-ray lithography, for instance. On the other hand, there are only a few research groups outside industry that are really woring in the forefront of industry, and thirdly only a rapid transfer of the research project into industrial utilization makes this kind of research project meaningful.

b) Research in the area of highly parallel super computers is being supported in the USA with large amounts of government funds. If it is possible to combine the demand of all the European research centers for super computers, the development of such systems and their application will lead to decisive stimulation on the part of industry. Innovative public demand can stimulate the development of research equipment, provided it reaches an effective, that is European, magnitude. The development of hard and software by super computers and the methodical principles upon which they are based are additional research topics of great interest.

c) There are two complementary starting points for researching biological information processing systems. One is based on neuro-biology and attempts to trace information acquisition, transfer, and processing techniques by analyzing chemical-physical processes; the other method is based on psychology and intelligence performance. It tries to draw conclusions based on the organization and processing of information. The various research groups in Europe address these very diverse research approaches and traditions differently, and it seems obvious that much closer cooperation using complementary approaches to research would be mutually fruitful.

These three examples show the multi-dimensional nature of European research cooperation.

However, international cooperation beyond western Europe is also important. This takes many forms, but it appears that we can gain the most from cooperation in those areas where we ourselves have the most to offer.

The quality of international research cooperation will consequently be directly determined by the quality of German research.

6. Methods, Organization, and Personnel for Distributing Subsidies

Superior basic research as well as the education of the next generation of highly qualified specialists for research and industry is primarily dependent on the persons who are in the position to assume the necessary scientific leadership. If these individuals are lacking or cannot be developed, subsidies will accomplish little.

Consequently the education of a new generation of leaders deserves the highest priority, but it is also important to attract leading scientists from abroad. We should increase our past efforts to give young scientists with leadership potential the specific opportunity to work in top-flight international research groups, primarily in the USA. Consequently we are currently preparing an appropriate limited-time program to supplement and strengthen existing fellowship programs.

The content and organization for accelerated expansion of research capacities in the area of information technology should be ready to begin on a broad basis by 1988/89 and be completed by 1992.

One limitation is that the total number of planning centers in research institutions in the Federal Republic can scarcely be increased substantially. Federal and state governments, research facilities, universities, and industry must work together closely in each individual area of study in order to find a specific form oriented to each given problem.

Workers in research facilities should not as a general rule work less than three years nor more than 10 years on a specific topic. This means that we need to work out organizational solutions and means for distributing subsidies that will support rather than hinder personal flexibility, but that are not set up in such a hectic or bureaucratic way that they prevent top quality research from taking place. We must also avoid the evolution of contacts between institutes and companies that result in contracts prohibiting transfers to third-party companies or that limit the utilization of acquired know-how if individuals go into business for themselves.

Given these considerations, there are four possibilities for achieving accelerated expansion of research capacities and all four forms should be utilized in order to adequately address the problem.

-- First of all, existing research facilities with their present planning centers and employees should intensify their orientation to research in the area of information technology. As we now see it, based on the medium range plans of the large research institutions, this reorientation will result in an increase of about 300 to 400 scientists by 1992, corresponding to a proportionate contribution from institutional subsidies on the average of 100 million DM/year in comparison to 1985/1986. In the process, the quality of research and its long-term orientation to the key problems involved in information technology must be ensured through the appropriate organizational and personnel decisions. Stronger competition in the area of institutional support would be desirable.

-- Secondly, project support for specialized topics relevant to information technology should be more strongly oriented to research in the forefront of to industry and at the same time, direct project support to industry should be reduced. This provides the possibility of building up considerable capacities through the project centers in existing research facilities. Given the current outlook, this would enable the federal government to finance approximately 500 to 600 scientists, provided that the states where the facilities are located also contribute to existing research facilities. To be sure, this form of support is only possible on a limited-time basis and is therefore particularly appropriate for research in the forefront of industry, for we can hope that at the end of an extended project or even while it is still going on, industry will have a demand for the employees or the research capacities of these institutes. This is ordinarily true in the case of high quality research in the field of information technology. The need of industry for experienced research personnel and research output should also remain high in the 90's, provided the critical German industrial sector is successful in achieving above-average growth in international competition.

-- Thirdly, it is obvious that industry should be involved in supporting and financing research facilities. Primarily in this way it would be possible to establish institutes to which workers from research facilities and from industry could be temporarily assigned in order to work on joint, goal-oriented research tasks, then returning to their parent organizations after completion of the project. This form of research should be given special preference in the case of large projects with clearly defined goals and time horizons requiring industrial know-how where the results need to be transferred effectively to industry. Support should be set up in such a way that research findings are not too one-sidedly tied to the companies participating in supporting the project, while still taking into consideration their justified interests and individual contributions. Initial estimates project that given the necessary readiness on the part of industry and the respective states, by the beginning of the 90's 400 to 500 scientists can be working temporarily on key areas of information technology in this kind of institution.

Utilzation of any remaining funds after the dissolution of this kind of institute must be assured at the beginning of the project by the appropriate support facility hosting the project.

-- A fourth form of research support, for which the states will be primarily responsible, exists in the universities. The states have to do more in this sector. In light of the central responsibility of the universities for basic research and the education of new scientific and engineering specialists, the federal government should nonetheless involve itself in specific, short-term measures. This commitment involves three stages: 1) providing special funds for the German Research Community for special research areas and key programs via participation of university personnel in the three forms of research support cited above, 2) project subsidies for research groups at universities working on joint projects, and 3) the granting of research projects to state institutes that have been founded at the universities. Additional state-sponsored expenditure for basic

university research in the area of information technology [would ideally] be financed in a range from 70 to 80 million DM and correspond to 300 to 400 scientists; these activities should obtain additional support from the federal government in the form of project subsidies.

Given full utilization of all possibilities, during the 90's we should be able to double our research capacity in the area of information technology with respect to our current status, although it remains undecided at the moment what weight each of the four possible avenues of subsidization will have in this development.

Doubling the capacity for basic research in the area of information technology would enable us to provide an appropriate response to the dynamics of industrial growth and to fill the research gaps that must be closed if the Federal Republic is going to remain a leading industrial nation on a European and international scale.

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BULL'S GROWTH POLICY, RESEARCH STRATEGY OUTLINED

Paris ZERO UN INFORMATIQUE MAGAZINE (Supplement to No 934) in French
8 Dec 86 p 13

[Article by Pierre Lombard: "United Front at Bull"]

[Text] Having united various quite dissimilar entities several years ago (Sems, Transac, etc.), Bull is today developing its image as a large industrial group, a strategy necessary to face up to the American data processing giants. But what is a large group in this industry? It can be characterized by, among other things, its capacity to innovate or the size of its R&D budget.

In R&D, the Bull group indeed attends to its reputation. In 1985 Fr 1.6 billion were invested in R&D by this leading French data processing manufacturer. This investment represents about 10 percent of the group's total turnover. It is distributed as follows: 1 percent for pure research and 9 percent for product development, a typical distribution in industry.

Collaborating With the University Community

To manage its R&D policy the Bull group has created a technological watchdog: the CRG (Group Research Center), whose job it is to coordinate research done by the Bull group on the one hand and conduct its own research on the other. Gerard Roucairol, a former government researcher, runs the CRG implementing a policy of close collaboration with the scientific community, universities in particular.

Thus, the Bull group keeps in touch with the large state-controlled laboratories (CNET [National Center for Telecommunications Studies], CCETT [Common Center for Television and Telecommunications Studies], INRIA [National Institute for Research on Data Processing and Automation], etc.) and in with laboratories of about 20 French universities and professional schools. In Gerard Roucairol's opinion, such collaboration should enable them to make early use of research findings from outside the Bull group. "We have no intention of competing with the university teams on their own turf," he points out. "We definitely need fundamental scientific advancement and improved understanding, but these are not our primary objectives. However, it is absolutely essential for the Bull group to develop its own research adapted to its specific needs." Thus, this

policy of cooperation with state research, applied through internships or decentralized university projects, does not conceal the Bull group's own interests. What are these interests? First, to improve existing products. Therefore, Bull Systemes works on software format specification, natural language interfaces, integrated circuit design, and machine architectures. Similarly, Bull Transac is involved in workstation development and artificial intelligence applications in office automation. Distributed systems and the SM-90 are the main concerns at Bull Sems. And at Bull Peripheriques, research revolves around magnetography and impactless printing technologies.

CRG's own research is more future-oriented. It has two main focuses: software engineering and structuring of information systems.

In software engineering the Bull group's war-horse is called Emeraude. It concerns the definition of an access structure for a software engineering workshop. In addition, to improve specifications definition, CRG is concentrating on developing executable specification languages which would make it possible to check the validity of a prototype data processing system. This research could result in products which can be used in the G-COS 7 environment.

The structuring of information systems consists of two parts. The first concerns distributed systems architectures. According to Gerard Roucairol, this is a strategic emphasis for the Bull group. The goal is to supply future distributed systems users with all possible advantages for communications, resource sharing, computing power, storage capacity, etc. The second part consists in developing specialized intelligent hosts. This is the special domain of AI, which should eventually transform databases into knowledge bases available to users. These knowledge bases would then process multimedia data, including texts, graphics, pictures, and voices, in coherent information structures.

Bull is also active in research on a European level. Apart from its AI work carried out at the ECRC (footnote) (European Computer Research Center: joint research center established in 1984 in Munich by Bull, ICL [International Computers Limited] and Siemens), the Bull group is involved in about 30 ESPRIT projects. This means that in 1985 the French manufacturer received over 15 percent of the budget allocated to the 12 EEC countries for ESPRIT activities.

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CHINESE DELEGATION VISITS SWEDEN'S ASEA ROBOTICS

Stockholm NY TEKNIK in Swedish 29 Jan 87 pp 8-9

[Article by Eva Bingel]

[Text] The dream of a new type of industry where robots and computer technology set people free is becoming a reality in Sweden.

Sweden probably has come further than any other country in the world in new production technology. Now foreign delegations are standing in line to study this technology and to see how our industry has dealt with problems involved in the conversion.

The first article in this NY TEKNIK series on changes in industry and labor deals with just such a delegation--from China--to Asea Robotics in Vasteras.

The Future Is Here

Not too long ago, futurologists dreamed about how robots and computers would liberate humans from direct product production processes.

Now the dream is becoming a reality in Sweden. Our country has perhaps come further than any other in the use of new production technology.

In just a few years, our industrial structure and the content of our labor have changed drastically. Blue-collar workers are becoming white-collar workers and white-collar workers are moving down onto the shop floor.

But this conversion is not without problems. New technology places new demands on management and employees. Delegations from throughout the world are traveling here to learn from Sweden's experience.

"No cameras," Reijo Palola said in English. Sun Liu Qun and 15 other Chinese engineers and managers turned around and went back to the bus.

When they returned without their bags and cameras, Reijo raised his voice and said:

"This is the largest robot factory in the Western World and the third largest in the world."

In this way, he herded the group into the ordinary looking building, the external appearance of which did not give away its great importance. When the metal door closed behind us, we stood in the middle of the assembly shop at Asea Robotics in Vasteras.

A truck that was washing the floor turned the corner and 16 frightened Chinese jumped against the wall.

"It is very clean in Swedish workshops," said Sun Liu Qun, who is vice president of a company that manufactures machines for the construction industry.

"Asea Robotics produces 2,000 industrial robots each year and 90 percent of them are exported," Reijo Palola reeled off routinely, once the group had reassembled.

He says the same things every day. This is because Reijo Palola is one of several employees at Asea who does nothing but show the plant to visitors. There are many visitors and they are becoming more and more numerous. Engineers, researchers, and politicians from all parts of the world want to study industrial robots and their new Swedish applications in production technology.

Overly Inquisitive

Sometimes Asea Robotics has found this foreign interest to be overly inquisitive.

"We are not anxious to let any more Japanese in. We were burned once when, following a visit by some Japanese, we later found them producing our robots. The Japanese are not especially good at coming up with new ideas, as we are, but they are darned good at taking an idea and developing it," said Goran Stensson, director of information at Asea Robotics.

It looked somewhat desolate in the large workshop, which led Sun Liu Qun to ask if the workers were on break. But they were not.

"Of the 600 employees of Asea Robotics in Vasteras, only 200 work in the shop on the direct production and testing of robots," Reijo Palola explained.

Although the ratio of white-collar to blue-collar workers is extreme in this case, compared to the average for Swedish industry, it still points to a trend that has become apparent over the past few years.

More White Collar Workers

The percentage of white-collar workers among the total number of employees has increased significantly in all branches of industry. Every day seven metalworkers become salaried employees in industry. This is a figure that is often used to describe the structural change that is taking place in industry.

There are many other measures. One of them is that a small number of major high-tech intensive companies have taken over basic industry's role as leading exporters. This year's budget proposal from the government states that, "A transition is taking place from raw-material based to knowledge based production."

In addition, it may also be noted that a shift in total industrial investments has taken place away from heavy basic industry toward lighter engineering industries.

Companies' increased investments in research and development (R&D) and in marketing may also be seen as a sign of the times. In just over 10 years the total R&D investments of Swedish companies have increased by 100 percent--from 20 to 40 percent of total investments. Swedish, along with American, companies now have the highest R&D expenditures as a percentage of total production costs.

The Chinese visitors were then taken to Asea Motor to study the robots in operation.

"Welcome to the first Asea company that began using robots in production. We did that 17 years ago. Today we have 30 robots in operation," local manager Tore Hellstrom said.

"That is more than we have in all of China, but you probably have even more than the Japanese," Sun Liu Qun whispered.

Sweden Highest Robot Density

The figures are uncertain, but an often-quoted OECD statistic says that Sweden is the country with the highest robot density in the world, with 30 industrial robots per 10,000 employees, compared to 13 in Japan and 4 in the United States.

Tore Hellstrom led the Chinese delegation on and demonstrated a robot for press casting motor parts.

"This is one of the most modern companies in the world for the production of electric motors. As you see, we are using robots to do much of the heavy work here in the shop," he said, pointing to a robot that was moving heavy motor parts.

"Very interesting," Sun Liu Qun said. He added that it was extremely instructive to see how new technology was being used to save human bodies.

"That is important, since technology must not simply be used to increase efficiency and productivity," he said.

"But not even Asea's advanced robots can do that," he said, pointing to a group of workers who were winding copper wire by hand.

"Just look at the arm muscles on those girls," Reijo Palola said somewhat impatiently as he tried to herd us on. We were on a tight schedule and the next group would soon arrive.

Changed Industrial Work

The introduction of electronics, numerically controlled machines, and robots in production has certainly changed the content of industrial labor. The change has probably been for the better for most workers, but for the worse for a few.

More and more workers are now involved in supervision, quality control, service, maintenance, and inventories. The roles of blue-collar and white-collar workers have become more and more similar.

So far, this is true primarily at the larger high-tech companies, but this trend is developing rapidly and the government and industrial organizations are doing all they can to spread the new production technology to small manufacturing firms, as well.

Not Just Robots

On the way to the next stop, Asea Automation, Reijo Palola explained to the Chinese guests that it was not just the individual robots that attracted customers from all over the world.

"Interest in entire automation programs is increasing rapidly. This includes both large and small control room equipment, together with robot control systems. It also includes total control systems for an industry, including personal computers for management control," he explained by way of introduction. Only young people work at Asea Automation, where control systems for even the simplest industrial robot are produced. The average age in the production groups that manufacture circuit boards is 28 years. The predominance of women workers is striking.

"Young and ambitious women who are interested in technology," Reijo Palola explained to the Chinese visitors.

They smiled and looked knowingly at one another.

When we asked why, Sun Liu Qun explained that they had guessed that the high productivity in Sweden was due to the fact that Swedes were just as disciplined as the Japanese and worked very quickly on production lines.

"But during our visit in Sweden, we have learned that this was more true in the past. Now it seems that you have begun to combine work tasks again. It is as if you have returned to an earlier system using craftsmen and professional workers who can do it all," Sun Liu Qun said.

"Very interesting, but a bit confusing," he added, giggling along with his friends.

"You see, most of my fellow countrymen on this trip are engineers. I am also a manager and I am interested in organizational and management questions."

"I would like to know more about why Swedish industry is turning away from the division of labor and the conveyor-belt principle and toward organizing workers in groups."

"Is it more efficient or is it a result of demands made by your strong labor unions?"

No Pictures

Sun Liu Qun wanted to take home to China a picture showing the relaxed style of the production groups at Asea Automation. Unfortunately, not even NY TEKNIK was trusted to take pictures inside the plant gates.

"I have not been in Japan, but I believe, nevertheless, that the Swedes are like the Japanese in many ways. You are just as efficient, but I believe you are more democratic and I think Swedish companies pay more attention to their workers than Japanese companies do."

Sun Liu Qun explained that he had drawn this conclusion after visiting other industries, as well, and especially after talking with representatives of Swedish management.

"They talk so much about the importance of human capital. I believe that is interesting," Sun Liu Qun said.

PHOTO CAPTIONS

1. p 8. The future is here in Sweden. Visitors from all over the world come to see how new production technology is being applied in one of the world's most automated countries. Here, Chinese engineers and managers study the cooling system for a motor made by Asea Motor in Vasteras, which is produced mainly by robots.

2. p 9. The Chinese engineers said they had much to learn about how new technology is used to save human bodies.

3. p 9. "You Swedes are like the Japanese. You are just as efficient, but you are probably more democratic," one Chinese visitor to Asea Motor said.

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OPTICAL SENSING, SIGNAL PROCESSING ON ONE CHIP AT FRANCE'S LETI

Paris ELECTRONIQUE ACTUALITES in French 6 Feb 87 p 14

[Text] The LETI [Electronics and Data Processing Technology Laboratory of the Atomic Energy Commission] has just developed an optoelectronic integrated circuit. This circuit puts into practice the knowledge and technological expertise accumulated by the laboratory in interfacing of optical and electronic circuits.

This circuit is an optoelectrical component which combines two different technologies, with the link created by the use of a silicon substrate which both parts share.

The component combines in a single silicon chip an optical circuit linked to detection elements and a microelectronic signal processing circuit. Its size is 5 mm x 10 mm. This component receives optical information through a fiber and produces an electrical signal representative of the light signal polarization.

The optical circuit has microguides made of silicon nitride (Si_3N_4) or of doped silica (SiO_2) [silicon dioxide], 2 μm wide; a polarization filter; and a diffraction grating (1μm lines), which transfers light to the detection elements (two integrated photodetectors). A CEA [Atomic Energy Commission] patent has been filed for this device, analyzing the values of the TE and TM components.

The electronic circuit is a series of operational amplifiers using CMOS technology (4-5 μm) for generating signals (preamplification, weighted sum and difference). It was developed by the ESIEE [Advanced School for Electrotechnical and Electronics Engineers], under the LETI's guidance.

The value of such an approach becomes apparent in the field of optical sensors, in which the LETI is working. This contrasts with the "integrated optoelectronic" approach Siemens has been using, working with lithium niobate for applications involving fiber optic and wide band telecommunications.

Establishment of CSO [Optical Sensors Company] by the End of March

By the end of March 1987, this work will lead to the formation of a company, the CSO, headed by Jacques Liset. It will make use of technology supplied by the LETI during its initial phase, which it is estimated will last for 2 to 3 years.

The sensors that the CSO is to produce are displacement sensors, or to be more precise, Michelson micro-interferometers measuring displacement and the direction of displacement (thus, wavelength resolution). Their size is 8 mm x 8 mm. Such sensors are used in dimensional metrology for precise measurement of dimensions, and there is also a demand for temperature-induced deformation monitors. This represents a varied demand spectrum, with the most precise covering displacements of several cm with a resolution of 10 nm, and the least sophisticated needing only coverage on the order of nm in displacement, with a resolution of 1 μm.

These sensors could also be used for compact-disc reading; contacts have been made with some major CD companies, whose names were not released.

In Osaka, Japan, the university is working on compact-disc readers using integrated optoelectronic technology. But it does seem that the different method is harder to handle.

This development is the result of LETI's collaboration with Merlin-Gerin, which financed this work through the CIFRE fund, as well as with an INPG/CNRS [Grenoble National Polytechnic Institute/National Scientific Studies Center] basic research lab, Germain Chartier's LEMO.

LETI's collaboration with Merlin-Gerin could continue, for the Grenoble lab does have the expertise needed to measure strong currents (3500 A, nominal) using the Faraday effect.

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CSO: 3698/302

FUJITSU TO MAKE SPAIN ITS EUROPEAN BASE

Parid ELECTRONIQUE ACTUALITES in French 30 Jan 87 p 4

[Text] Madrid, AFP [French News Agency]. "The decision-making process in a Japanese company takes a very long time, but once we have made a decision, we act very quickly. This will be the year when Fujitsu really gets started in Spain."

Mr Chiaki Sugishima, the representative in Spain of Fujitsu, one of the major companies in computers, could not give clearer notice of his company's intentions in the Iberian peninsula. The objective of the 5-year plan begun in 1986 is to make FESA [Fujitsu Spain, S.A.] number two in the Spanish computer market.

FESA's new chairman is Adrian Piera. Its 1987 goal is to increase sales in Spain by 25 percent over 1986, to 22.3 billion pesetas ($171.5 million, with an exchange rate of 1 dollar to 130 pesetas). In 1989, FESA expects a sales volume of 65 billion pesetas.

The Japanese leader in computers is aiming high, extremely high, for its move into the Spanish market really began just a little over 2 years ago. To establish a computer company, in July 1985 Fujitsu signed a joint venture agreement with SECOINSA [Spanish Communications and Computer Company, Inc], owned by the state holding, INI [National Institute of Industry], until it was taken over in March 1985 by Spain's semi-private telecommunications company, Telefonica. According to the terms of the agreement, Fujitsu owns 60 percent of SECOINSA's capital, and Telefonica the remainder.

The big advantage the Spanish market has over the other European countries is that Spain has practically no national electronics industry of its own to protect. Just 6 months after Spain entered the EEC on 1 January 1986, the time was perfect for FUJITSU to move into Spain.

Fujitsu got a double bonus: first of all, the company was moving into a potential market of 40 million people, and secondly, it could use Spain as a base for its later infiltration of the European Economic Community and

Latin America. "Spain is to be our main base in Europe," pointed out the FESA representative, adding that to make this a reality, his company will increase its technology transfers from the parent company in Japan.

Of course, Fujitsu had prepared its way well in advance; Fujitsu worked with Telefonica and the INI in setting up SECOINSA--back in 1975.

Now, 12 years later, the Japanese firm plans to reap the fruits of its efforts, by moving ahead at top speed in its Spanish campaign.

This year FESA plans to triple the investments it made in 1986, to double the number of its employees during the next 3 years (from 1,300 to 2,600) and to quadruple the annual production capacity of its Malaga plant (located in Andalusia in southern Spain, in a former SECOINSA plant).

"In 1987, the increase of our share of the Spanish market will come from a new product we are going to introduce," explained Mr Sugishima. This new computer, which FESA did not describe more precisely, will be introduced "soon," according to a spokesperson.

To give itself the best possible chances of making Spain its "main base in Europe," FESA also plans a major expansion of its research and development activities. A third research center, added to the ones in Madrid and Barcelona, will be located near the Malaga plant on a 12,000-square meter site. It will be used "for research on telecommunications and top-of-the-line computer products," explained Mr Sugishima. FESA's research department now employs 190 people. It plans to expand this staff by about 100 people during the next 5 years.

Fujitsu Spain also plans a major drive to go after Spain's personal computer market, where so far it has not had much success.

"Our short-term objective," said Mr Sugishima, "is to get 20 percent of this market." To get into the Spanish PC market, FESA plans to focus on two lines of action: improving its after-sale service, and marketing a new IBM-compatible software product.

Fujitsu's enormous effort in Spain is certainly one of the best illustrations of the thrust by Japanese companies into the Iberian peninsula in the past few years, which has become especially pronounced since 1984. Spain's share of total Japanese investments in Europe practically tripled in the first half of 1984 in relation to the first 6 months of 1983: up to 10.32 percent from 3.76 percent.

Spain also has the second highest number of plants (in Europe) wholly owned by Japan located in its territory (18). The Federal Republic of Germany has 20 entirely Japanese plants.

Big names in Japanese industry, like Nissan, Honda, Sony, Yamaha, Suzuki and Matsushita (National Panasonic) have also begun to fall into line in the past few years, and have turned their gaze toward Spain. A European diplomat predicted that by the end of this century, Spain could become the "California" of Europe.

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CSO: 3698/302

THOMSON CLAIMS WORLD'S FASTEST CHIP

Paris LIBERATION in French 23 Jan 87 p 27

[Article by Dominique Leglu: "Thomson Invents the World's Fastest Chip"]

[Text] The third generation chip is here. It will lead to better utilization of very high frequencies. Strong interest from the military, which is already taking a close look.

Silicon, symbol of the modern era and of the computer chips at the core of communications, is old enough to be a grandfather. Gallium arsenide--the next generation of semiconductor material--was barely peeking out from the laboratory to conquer its share of the market, when a grandson suddenly emerged, with a name that is even harder to pronounce and with a performance that is more than promising.

It's a world first. Thomson announced yesterday that it has succeeded to fabricate field effect transistors on a gallium indium arsenide alloy. This lingo hides the latest, and especially strategic technology. Thanks to it, all radio guided systems for ballistic missiles could very well be changed in three years. Simply put, it means that receiving antennas will be no larger than thimbles and that the military would have fewer atmospheric transmission problems; it could make better use of very high frequencies, while disregarding weather problems.

Originally, it was all a "very simple" matter: fabricate electronic circuits with a higher performance than those made from silicon or gallium arsenide (GaAs). In other words, provide chips that work better in the famous hyperfrequencies so dear to the military.

But it's not enough to want, you also have to deal with the fundamental physics of materials.

In a silicon transistor, electrons move with a given mobility which directly determines circuit capabilities. The higher the electron mobility in the circuit, the higher the electromagnetic wave frequency with which it can work.

But silicon has its limits. That is why everyone sought to develop other semiconductor materials in which the electrons move faster. Such is the case of gallium arsenide, a crystal mixture of gallium and arsenic, in which the electrons move two to six times faster. While the first research started during the 1960's (in 1961-1962 at Thomson), sales only began two years ago. This should give us an idea of how difficult it is to perfect this type of electronic circuit.

But they wanted to do even better, hence the hunt for a new material with even better performance; the lucky winner is gallium indium arsenide.

In theory, it is once again rather simple. What you have to do is substitute indium atoms for gallium atoms; both elements have the same number of outer electrons--three, which gives them serious similarities, chemical ones in particular. The substitution can take place without commotion; however, small physical differences between them causes significant overall changes, hence electron mobility is even further increased.

So much for principles, which have been known since the 1970's. A device still had to be produced. "The material itself was made in 1981-1982," explains Jean-Pascal Duchemin, head of the III-V Semiconductor Group at Thomson's Central Research Laboratory (LCR).

The physico-chemical cookery for producing crystals is closer to steaming than stewing. All the elements, gallium, indium, and arsenic, are introduced as a chemical gas into a sort of common pot, and little by little, the chemicals become deposited to form a crystal as pure as possible. "At the beginning of the 1980's we were the only ones to master these processes," points out Mr Duchemin.

The actual transistor still had to be made. As Pierre Gibeau, technical leader at Thomson's Corbeville center reminds us, "to understand a transistor, you have to think about a water pipe with a valve attached to it," which controls the water flow. In a semiconductor, the electrons are the "flow" and the transistor's valve is a "grid," often in the form of a rare metal such as gold, platinum, or titanium.

As fate would have it, no one knew how to make grids for gallium indium arsenide; "conventional" grids simply cut off the electron flow. A more subtle faucet was needed, and that is what LCR succeeded in doing by assigning two people full time for one year to the problem. A remarkable success for a task of two-fold complication: first, to find the right material (another semiconductor, indium phosphide, in this case), and next, to work with great precision. Indeed, the smaller the grid, the shorter the time the electrons spend in its vicinity, and the higher their frequency. And that is exactly what you want.

Thanks to very sophisticated electrochemical techniques, and "to the hand of a chemical engineer who was able to etch a grid as small as 0.5 microns (or one-half thousandth of a millimeter)," in the words of Mr Duchemin, it was possible to make the famous transistor. It was born in the Orsay Laboratory two months ago.

It demonstrated its quality from the first tests. At frequencies of 18 GHz (billion Hertz) (Footnote 1) (the current in our light bulbs is only 50 Hertz) it registered a gain of 10 dB, in other words a ratio of 10 between output power and input power. This is a first rate result, equal to the best performances obtained with GaAs circuits.

From the start, a mere prototype has equalled the best components. Improvements are expected to further increase the frequency, so that these circuits will operate "in the atmospheric window of 94 GHz," explains Mr Duchemin; in other words, the frequency near and dear to the military.

From the standpoint of research, LCR can be justifiably proud since all the large laboratories in the world (IBM, NEC, Toshiba, Fujitsu, LEP, Plessey, and British Telecom), are in a race for new semiconductors.

Commercially, the stakes are more difficult to estimate. Very soon, the military will clearly be the user of this Rolls-Royce of transistors. It is therefore difficult to assess the market for these components; we can rather imagine that they will bring about new systems with new antennas, new radars, and so on; products of which only dozens will be sold. Only much later might there be much larger civilian economic spinoffs, which are impossible to determine today.

One thing is certain, the development of this system has cost about 50 million francs in research.

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EUREKA SUBMICRON PROJECT ADVANCING

Kalmthout INDUSTRIE in Dutch Jan 87 pp 14-15

[Article signed W.H.: "UCB Launching into Microelectronics"]

[Excerpts] UCB Electronics is the name of a new subsidiary of the Belgian chemical manufacturer UCB. Started up on 3 September 1986, it will concentrate entirely on photosensitive resins for the electronics industry. UCB Electronics has recently attracted a lot of attention with the introduction of Plasmask, an ultraviolet-sensitive photoresist capable of producing 0.4-micron features on chips. Plasmask was developed in conjunction with IMEC [Interuniversity Microelectronics Center] and with the support of the IWONL [Institute for Scientific Research in Industry and Agriculture].

Moreover, in order to offer a complete range of microresists, UCB concluded an agreement with Japan Synthetic Rubber Co. Ltd. in Tokyo, a major manufacturer of chemical specialties for electronics. This company licensed UCB to promote, adapt, and distribute all its microresists in Europe.

Simply launching a photoresist with submicron capacities on the market is not sufficient to be commercially successful. A great deal of work will still have to be done on the plasma-etching machines, i.e., machines which remove the parts of the photoresist protected from ultraviolet-light. That is why UCB Electronics, IMEC, and England's Plasma Technology are now jointly involved in a EUREKA (European technology program) project for the development of dry-etching equipment. UCB is developing the purification technology which should lead to megabit quality. This requires clean-room facilities with contamination levels that can be expressed in ppb (parts per billion).

In order to purify, formulate, filter, and bottle the electronic chemicals, UCB has set up a class-100 clean room in the existing VEL facility in Haasrode, Belgium.

Dr August Vrancken, head of UCB Electronics, was the driving force behind these new light-sensitive resins.

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FRENCH TECHNOLOGY STUDY CENTER'S GOALS, PROJECTS

Paris ZERO UN INFORMATIQUE in French 29 Dec 86 p 4

[Article signed C.P.: "CESTA Betting on Self-Financing;" first paragraph is ZERO UN INFORMATIQUE introduction]

[Text] Profitability takes priority at CESTA. This EPIC [public enterprise] (which must part with a third of its staff) will continue its mission in 1987, provided sales revenues make up for the decrease in public aid.

CESTA is looking for partners. This is the appeal from CESTA (Advanced Systems and Technologies Study Center), which will see the 1987 subsidy from its governing ministry (Research and Higher Education) reduced by 30 percent (to Fr 19.1 million compared to Fr 24.4 million this year), in a budget of Fr 38 million. Public aid was already cut by Fr 6 million in the third quarter of 1986 (this funding cancelation appeared in the JOURNAL OFFICIEL dated 22 November).

At the same time, the staff will also be reduced by 30 percent, according to CESTA's President Pierre Chavance--or by half, according to the staff, which went on strike on 11 December. The dismissals are dictated by ministerial instructions, but "should not affect the major activities." CESTA is thus betting on an increase in self-financing of some 20 percent, the company's own commercial resources being due to reach 47 percent in 1987.

Despite CESTA's threatened future (Pierre Chavance admits that he was given no guarantee by the authorities that CESTA would still exist in 1988), CESTA should continue its mission at least through next year. The recommended plan will assure a certain continuity in work already begun by the center's four departments (names after the targets of their activities): business, communications, education, and life science technologies.

Priority is given to the business sector. Here, CESTA must make small- and medium-sized companies aware of the risks and opportunities of new technologies and develop a methodology for action with financial partners and labor and management, using a network of robotics experts for this purpose.

Benefiting from its international experience, CESTA has begun development of a EUREKA database on European high-tech companies--not to mention an experimental

program to modernize conventional activities (the center acts at a European level to coordinate the textile, leather, footwear, and ceramics industries).

In order to disseminate these modernization techniques, CESTA organizes seminars (in factory and office automation, maintenance, and industrial organization), as well as one-day information and training sessions at the local level, with the support of CCI's [Chambers of Commerce and Industry], among others.

The Education Department, for its part, has three main foci. First, CESTA has established Europe's first resource center for educational applications of new technologies. The "didactheque," which today includes 1,200 to 1,500 educational software programs (products of the CNDP [National Center for Pedagogical Documentation] and major publishers, Data Processing for Everyone Kits...) accessible on some 40 microprocessor systems, has had approximately 7,000 visitors since it opened in January 1984.

Directories specifying the status of educational software resources have been compiled. After a first volume on didactic software, a second, on training software, will be published next year.

The "robotheque," with some 20 educational robots, serves as a training center for teaching on individual robots.

CESTA's data communication service, Cestel Plus, can now be accessed on the "kiosque" network. From a Minitel station, users can consult a bibliographic data bank listing some 1,000 selected titles on new technologies. There is also an electronic newsletter, and Didactel (a first electronic directory listing 1,000 didactic software programs which is scheduled for joint Cedic/Nathan publication by the end of January).

Finally, this department constitutes a focal point of expertise on new educational technologies. A colloquium on "the future of education and education of the future," scheduled for 1987, will not fail to bring out artificial intelligence developments in this field.

CESTA not only provides guidance for research, but also conducts work within the framework of the European Communities' FAST II [Forecasting and Assessment of Science and Technology II] program and assures the coordination of two European research networks on questions relating to educational applications of new technologies.

The Communications Department is organized around three foci. First, the multimedia seminar, consisting of a cycle of high-level conferences on the evolution of communications technologies, computer law, markets for news media, industrial policies, and investment strategies. Intended for 30 decisionmakers from the communications world, the next one will begin on 10 February and finish up in May with a study trip to the United States. Its main purpose is to develop a "club," a network of persons who will remain in contact.

Artificial intelligence and electronic images are the other foci. Under the name of "Mari 87" (Intelligent Machines and Networks), the Cognitiva 87 Colloquium and the third International Week of the Image will be held concurrently from 19 to 23 of next May in the scientific center of La Villette.

Four Interdependent Departments Covering 90 Percent of Requirements

The life science technologies program includes three major sectors: biotechnology, agro-food, and biological and medical engineering. The conducting of studies, one-day sessions designed to increase the technological awareness of various professional circles (sessions devoted to "new hospital technologies" will be continued and other sessions organized on "new life science technologies"), and aid for the development of international cooperation constitute the principal activities in this area. CESTA in fact manages the international biotechnology network, which aims at training students from developing countries and promotes international researcher exchanges.

"Through these four interdependent departments which share a common approach to problems, we believe we cover 90 percent of requirements," P. Chavance points out.

As for publications, the center admits that "development here has not been as orderly as elsewhere." A collection of high-level works is planned; it will be added to reports on the center's work (following the example of the proceedings of the June 1985 international colloquium on "new technologies and fashion," which have finally been published).

Only three of five publications will be continued in the future: LA LETTRE DE L'IMAGE [Image Newsletter], INTELLIGENCE ARTIFICIELLE, and LA LETTRE DES METIERS DU FUTUR [Future Occupations Newsletter].

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FINLAND, EUREKA IV: FACTORY AUTOMATION, BIOTECH, SENSORS

Helsinki FORUM in Swedish 22 Jan 87 p 18

[Article by Hakan Nylund]

[Text] Eureka's ministers' meeting in Stockholm in mid-December was a routine meeting in a positive sense. To a certain extent, the ministers were pleasantly surprised to find that Eureka was working well, including the compact new secretariate and Eureka's data bank. Approval was given to 39 new projects, including four in which Finland will participate.

As a result of the Stockholm meeting, the fourth meeting of ministers, Eureka now consists of 109 projects with a budget of 3.5 billion ECU (European Currency Units) or about 17.8 billion markkas. An additional group of about 40 projects are being examined and most of them will probably come up at the next meeting in Madrid this coming fall. So far, the ministers' meetings have been held semiannually, but a longer interval between meetings is now planned--not because of sagging interest, but because Eureka is working.

The Eureka projects have not only become more numerous, but they have also become smaller and involve more small and medium-sized firms. Individual project budgets are now in the million ECU range (1 ECU equals about 5.1 Finnish markkas).

Management Training

"This is a positive trend, since Finland has stressed all along that small and medium-sized firms must be included in the work," Trade and Industry Minister Seppo Lindblom said. "The industrial problems of Europe will not be solved by investing in large companies, since they are already strong. We must invest in small firms."

Management training plans that were approved at the ministers' meeting will give a helping hand to small firms. This training is intended to give smaller companies the ability to manage high-tech development projects involving several countries. Great Britain, which made the proposal, was given the task of making plans for this project and presenting them at the next meeting. Initially, the training would be financed by Eureka, but it would later be placed on a commercial basis if there were enough support.

Trade Barriers Present Obstacles

In its final communique, the ministers' meeting called attention to trade barriers and pointed out the importance of developing Europe into a common domestic market. About 15 Eureka projects have already run into trade barriers, most of them not tariff-related, that require international measures. The ministers stressed, however, that Eureka itself should not become involved in trade policy, but that trade policy should be dealt with by existing organizations.

"Eureka's significance in trade policy lies in the fact that, during the course of concrete cooperation, it discovers the obstacles and hindrances that exist. Eureka can then point out these problems to the proper organizations, such as the EC and EFTA," Lindblom explained.

Of the four new Finnish projects, Partek's wollastonite project received the most attention, since it was chosen to be one of the projects that were presented to the press. This project involves research on the use of wollastonite as a reinforcement material for polymers. The first phase is investigating wollastonite and polyurethane. The foreign partner is the Belgian firm Recticel, but the goal is to expand the project to include other plastics and other companies.

Small Finnish Firms Included

Neles Oy Lokomek, a subsidiary of Rauma-Repola, has joined forces with Hydrolux of Luxembourg in the project "Intelligent Quattro." The goal is to develop an intelligent mechanical/electronic automation and remote-control system for hydraulic machines and vehicles. The technology will be used for all-terrain vehicles, the processing industry, and factory automation. The project will cost 2.1 million ECU.

The Kuopio firm Puumalaisen Tutkimuslaitos, which is behind the OTC-listed Roibox, is involved in two new Eureka projects. Together with the Swedish company Kvantek AB, it will develop electron beam technology for applications in the processing industry. This technology will be used to clean combustion gases at power plants. It will also be used in the production of plastics and in biotechnology.

The second project involves encapsulation machines for the pharmaceutical industry. The English partner Manesty Machines will provide expertise in machine construction and electronics, while the Finns will offer their know-how in measurement and sensor technology. The cost of the projects is estimated at 3.3 and 0.5 million ECU, respectively.

A potential Eureka firm is Hydrolab, located on Aland. It is participating in a project on vacuum technology for the computer industry. This project is not yet on the Eureka list, but it is expected to be included later. Nokia is becoming involved in a major project for the development of so-called high definition television and in the large ES-2 project. ES-2 is working with the automated design and production of made-to-order semiconductors.

"Eureka's practical importance should not be overestimated, but even the atmosphere and the contacts are of great importance," Seppo Lindblom stated. "We Finns have every reason to be pleased with Eureka. Finnish firms are involved in just over 10 percent of the projects and our participation will certainly increase at the Madrid meeting."

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ITALY, BRAZIL TO ACTIVELY MARKET NEW AMX

Sao Paulo GAZETA MERCANTIL in English 19 Jan 87 p 6

[Text]

Embraer, the federally-owned aircraft manufacturer, announced Tuesday the creation of AMX International, a marketing subsidiary for its AMX fighter program. "AMX International will be headquartered in London, where its main function will be to market the jet internationally," said press spokesman Antônio Augusto de Oliveira.

The AMX is a subsonic jet fighter-bomber being developed by Embraer, which is responsible for 30% of production, and two Italian companies, government-owned Aeritalia with 45% and privately-owned Aeronautica Macchi SpA with 25%. The Brazilian and Italian air forces have placed orders for 130 planes each beginning next year, but the joint venture hopes to sell the jet to other countries, for a projected $10 million apiece.

Analysts predict that the AMX will be targeted at air forces seeking to replace early models of the French-built Mirage, some models of the Russian MiG and U.S. A-4 Skyhawks (used extensively by Argentina in the 1982 Falklands/Malvinas War, for example).

So far, five AMX prototypes have flown successfully. Only one more is needed to start production of two units a month at Embraer's plant at São José dos Campos, about 60 miles east of São Paulo, Oliveira claimed.

Meanwhile, Embraer has awarded a $12 million contract to Aeroeletrônica S.A. to supply avionics for the AMX fighter program. Aeroeletrônica is a subsidiary of Aeronaves e Motores S.A. (Aeromot), a Rio Grande do Sul-based aircraft builder and dealer. It will supply four systems for the first 300 AMX jets.

According to João Cláudio Jotz, Aeromot's technical director, Aeroeletrônica will produce the AMX's energy generation control unit and current transformer assembly system, using technology licensed from Sundstrand Corp. of Rockford, Ill., and Astronautics of Milwaukee, Wi. Aeroletrônica will pay 5% royalties to the U.S. companies.

It will itself develop the plane's external power control unit and an alert system that notifies the pilot of an emergency via a bell or voice.

To meet the AMX order, Aeromot plans to invest $5 million in a new plant in Porto Alegre, state capital of Rio Grande do Sul. Jotz expects Aeromot to complete the plant by October. The company will hire 100 more electronics engineers to work on the project, he says.

The order paves the way to a more lucrative $40 million contract to supply the AMX with more equipment, Jotz forecasts. He expects Embraer to award the contract to Aeromot within two months. Four types of equipment

will be involved for the first 100 jets: munitions control systems, pilot visors, inertial reference systems, and radio transceivers.

Not content with becoming one of the leading Brazilian suppliers for the AMX program, Aeromot is casting an acquisitive eye on Indústria Aeronáutica Neiva, Embraer's light aircraft division which is being put up for sale.

Claúdio Barreto Viana, president of Aeromot, says he's preparing an offer together with Embraer's nine other dealers to buy Neiva, whose assets Embraer values at between $11 million and $12 million.

Neiva turned out 110 airplanes last year and says it will sell 135 this year. It produces six models, four of which designed by Piper Aircraft Corp. of the U.S., and two by Embraer itself.

• As part of a federal investment program decided Monday (page 3), Embraer will receive Cz$ 1 billion (now $64.5 million) for development of the EMB-123 commuter liner, a joint project with Argentina's Fábrica Militar de Aviones. The EMB-123, a 19-seat pressurized turboprop, will replace Embraer's Bandeirante in the coming decade.

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NEW U.S., COCOM PRESSURES TO CONTROL SWEDISH PRODUCT EXPORT

Stockholm NY TEKNIK in Swedish 29 Jan 87 p 2

[Article by Mikael Holmstrom]

[Text] American industry's dissatisfaction with United States export controls threatens to affect Sweden and Swedish industry.

A recent report demands that the Western countries beef up their controls of high technology. Sweden is mentioned in particular.

For Swedish industry, the proposal means that purely Swedish goods would be controlled. For the Swedish government, this could put more strain on Swedish neutrality.

The report attracted much attention when its contents began to leak out 2 weeks ago. The report says that 200,000 jobs and $6 billion in export revenues have been lost because of the American export controls. These conclusions were backed by the American Academy of Sciences and Academy of Engineering Sciences.

Now that all 600 pages have been made public, however, it may be seen that the report does not in any way question the reasons for the controls. On the contrary, on the basis of secret materials, the report maintains that the Soviet Union must continue to be prevented from obtaining advanced Western technology.

For this reason, the United States and the other Western countries must build up more effective export controls. Since the United States is no longer the world's leader in technology, the controls must also keep up with technological developments in Europe, Southeast Asia, and Latin America.

Transferred

In plain language, this means that some of the controls now applied by the United States itself will be transferred to other Western countries. The controls will be tougher for these countries--and restrictions will be relaxed for American industry.

The study group made 15 recommendations. Nine of them apply to relations with other countries and affect Western Europe and Sweden directly.

The basic idea is that the allies of the United States within COCOM (Japan plus the NATO countries, except Iceland) will agree to more efficient cooperation. COCOM is a secret cooperative organization with headquarters in Paris. The idea is that the COCOM list of controlled high technology will be shortened somewhat, but at the same time the controls will be expanded from trade with the East to also include exports and reexports to other countries outside COCOM--to Sweden, for example.

Neutrals Drawn Closer

One important recommendation is to draw the neutral countries closer to the Western powers:

"The United States, together with the other countries within COCOM, will negotiate extensive agreements or informal arrangements with non-COCOM countries in the free world," the report says.

As a reward, American technology would be made more readily available to these countries. This would be done on the condition that the countries also control their own domestic technology, however. Purely Swedish goods exported to the Warsaw Pact countries and to "noncooperating" Western countries would be placed under Swedish controls.

Collision Course

Thus, this policy is on a collision course with Sweden's official position. Last year when the government introduced export controls for foreign high technology it stated that, for reasons of neutrality, Sweden could not expand the controls to include Swedish-produced technology.

Sweden is one of the countries that the authors of the report examined and visited for "frank and confidential talks" (see NY TEKNIK 1986:6).

Balancing Act

"Representatives of the Swedish government and industry indicated that, although they do not like the extraterritorial demands contained in the American export controls (especially with regard to reexports), they are following the rules and will continue to do so," the report states. But it also notes the following:

"In all their efforts, however, the Swedes must perform a balancing act in order to maintain their neutral position. They are subjected to constant criticism from the Soviet Union for 'doing the dirty work of the United States' in export control matters."

The study received both government and private funding. In addition to industry representatives, such heavyweights as former vice CIA chief Bobby Inman and former Secretary of Defense Melvin Laird signed their names under the conclusions of the report.

The foreign policy sections are in basic agreement with the policies of the Reagan administration, but they go further. But the remaining six recommendations criticize the controls for being too clumsy and too extensive. They also say that the power struggle between various departments is crippling the government.

"This report is both a recommendation to the present government and a blueprint for the future," project leader Mitchell B. Wallerstein, who is responsible for the report, told NY TEKNIK.

He stressed that the report had come at a good time--just as Congress was discussing trade laws measures to combat the large American trade deficit. In addition, the export controls will be taken up for reapproval by Congress 1 year from now.

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NORWEGIAN TECHNICAL RESEARCH GROUP WOOS SWEDISH INDUSTRY

Stockholm NY TEKNIK in Swedish 29 Jan 87 p 7

[Article by Christer Kallstrom]

[Text] Trondheim--The Norwegian research institute SINTEF (Foundation for Industrial and Technical Research at the Norwegian Institute of Technology) wants to conquer Sweden.

Together with the Academy of Engineering Sciences (IVA), the institute is putting on a seminar this February in Stockholm to introduce itself to a large group of Swedish industrial leaders.

SINTEF in Trondheim is now doing some research for Asea, Volvo, and KemaNord.

Funding for SINTEF has been reduced, due to the drop in oil prices. Is this behind the campaign in Sweden?

"No, it is not," market developer Terje Bakken of SINTEF told NY TEKNIK.

"Since Sweden is our largest market outside Norway even today, it is only natural that we would begin an international campaign there."

"Our goal is to increase our research contracts with Sweden fivefold over 5 years."

In Sweden SINTEF will concentrate on obtaining research contracts in information technology, materials technology, energy technology, manufacturing technology, medical technology, and biotechnology.

The SINTEF group, with its 2,000 employees, is the largest technical research center in Northern Europe. Ninety percent of the group's income is the result of contract research for industries, public agencies, and research councils.

The various institutes within SINTEF are now working on about 5,000 projects.

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POLISH GOVERNMENT RESOLUTION ON R&D

Warsaw MONITOR POLSKI in Polish No 34, 30 Dec 86 pp 413-414

[Text] Resolution of the Sejm of the Polish People's Republic, dated 18 December 1986, on the subject of a new system for guiding the development of scientific research, technical progress, and applications

The Sejm of the Polish People's Republic takes note of the government's report on a new system for guiding the development of scientific research, technical progress, and applications, and methods for implementing it during the period of the current national socioeconomic plan.

The need to accelerate scientific-technical progress while utilizing new economic and organizational solutions, the general goal of which is the utilization of the results of scientific research and the effects of technical progress in economic practice, follows from the general assumptions of the economic reform and the concept of the country's development for the next few years and until the year 2000, and also from the resolution of the 10th PZPR Congress, in the section devoted to scientific-technical progress.

The unsatisfactory level of the modernity of production methods, and the high materials-intensiveness and energy-intensiveness of our economy, require resolute systemic changes.

Considering the country's economic situation, it is necessary to make certain choices and concentrate resources in areas that are particularly important for technical-economic progress, ones that determine the rate of such progress.

The Sejm notes with satisfaction that the concepts presented by the Government for a system for guiding scientific research and the process of applying scientific-technical solutions meet the requirements and needs of our economy. At the same time, the Sejm calls attention to the fact that systemic solutions will only create the essential legal and organizational infrastructure. It is therefore necessary to increase the efforts toward the consistent introduction of model and systemic-institutional changes, and to enhance the incentives for their adoption in the national economy.

An assessment of the central research programs leads to the conclusion that the research has been correctly focused, and that appropriate research

problems have been selected, most of which have been directed toward practical applications.

The Sejm calls attention to the need for better coordination of research plans, government orders, and investments with the programs for restructuring the national economy, in the direction of a production model with a high degree of processing of raw and other materials. It is also necessary to establish a stronger link between research problems and the plans for the development of individual areas and spheres of activity.

A system for financing research and applications has been created, as well as several incentives, reduced rates, and preferences for enterprises that apply to production the results of scientific-technical progress in the form of new techniques and technologies.

The Sejm notes, however, that the introduction of new mechanisms for guiding scientific-technical progress is still taking place too slowly. In individual cases there is a lack of cohesion among activities supporting the process of scientific-technical progress, and a lack of continuity in its implementation.

The Sejm sees a need for making an assessment of the reasons for the systematic growth of unutilized resources accumulated in the funds for scientific-technical progress created at the enterprises, and a need for changes in the principles of the administration of those funds.

Because the national economy's receptivity to innovations will be determined, among other things, by credit policy, tax policy, and the rules for the establishment of prices, the Sejm recommends making an annual assessment of the effectiveness of the currently introduced financial-economic mechanisms for guiding the development of science and technology. Parallel action is necessary in the spheres of normalization, standardization, and improvement in the quality of products, materials, subassemblies, and tools. The rate of the mechanization and automation of individual steps in the production process should be increased.

The Sejm considers it necessary to increase the possibilities for training specialists for the modern branches of production and for the fields of science and technology developed in accordance with economic needs, and also to develop means for the systematic influx of these personnel into the spheres of science and production.

Utilizing the enormous intellectual potential of higher education is a matter of the greatest importance.

The Sejm supports efforts aimed at considerably increasing the participation of higher schools in the fulfillment of the central research programs. Improving the activity of higher schools as centers of modern scientific and technical thought will contribute to this.

The economic-financial system of design bureaus and the rules for the determination of prices for design work and the fees of the designers require special analysis; the new system should contain more effective incentives for the initiation of modern design solutions.

A beneficial aspect of the program for guiding scientific-technical progress is the assistance it receives from the development of international cooperation, conducted mainly on the basis of the "Comprehensive Program for the Scientific-Technical Progress of the CEMA Member Countries Until 2000," and the "Long-Term Polish-Soviet Comprehensive Program for Technical Progress," as well as bilateral agreements.

The Sejm notes that these programs create the conditions for the scientific and technical integration of the CEMA countries, and also outline the prospects for the development of lines of research and developmental work. In order for these aims to be realized more effectively, it is necessary to create a suitable base of scientific-technical, economic, and organizational information. The Sejm sees a need for further improvement in information systems, and for providing scientific institutions with a better supply of equipment, scientific measurement apparatus, and scientific literature presenting the directions and developmental trends of world science.

Taking into consideration the long-term strategy for the country's socioeconomic development, the Sejm considers it necessary to undertake at once work on defining the principles and directions of the state's policy in the area of science and technology until the year 2000. At the same time, the Sejm notes that it is essential to make an assessment of the state of the techniques and technologies that are particularly important from the viewpoint of scientific-technical progress, and also to develop a program for overcoming the technological gap by the year 2000.

The Sejm acknowledges that scientific-technical progress should be a process that is not only centrally guided, from the top to the bottom of the economic structure, but should also possess strong sources of inspiration in the lower elements of that structure. The combined efforts of the entire society are needed in order to support and promote initiatives and activities aimed at utilizing, disseminating, and reinforcing the achievements of science and technology and modern methods for the organization of social life.

The Sejm expresses its conviction that scientific-technical progress and the development of scientific research will contribute to improving the situation not only in the area of production and technology, but also in other areas of social life, including those of environmental protection, health care, housing, agriculture, and the dissemination of culture.

The Sejm calls upon the bodies of the state and economic administration, the people's councils, social and professional institutions, and political organizations to combine their efforts in the further stageof the adoption of the new system for guiding science and technical progress, in the direction of

supporting and promoting all initiatives and activities of our countries' citizens that are aimed at accelerating the country's socioeconomic development through the utilization, dissemination, and reinforcement of the achievements of science and technology.

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- END -